Modicon M171 Optimized Logic Controller

Hardware Guide

Original instructions

Schneider Electric

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As part of a group of responsible, inclusive companies, we are updating our communications that contain non-inclusive terminology. Until we complete this process, however, our content may still contain standardized industry terms that may be deemed inappropriate by our customers.

Table of Contents

Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Intended Use

The products described or affected by this document, together with software, accessories, and options, are controllers, intended for commercial HVAC machines according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component in an overall machine or process, you must ensure the safety of persons by means of the design of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

Prohibited Use

Any use other than that expressed above under Intended Use is strictly prohibited.

The relay contacts supplied are of an electromechanical type and subject to wear. Functional safety protection devices, specified in international or local standards, must be installed externally to this device.

Liability and Residual Risks

Schneider Electric liability is limited to the proper and professional use of this product under the guidelines contained in the present and other supporting documents, and does not extend to damages caused by (but not limited to):

- Unspecified installation/use and, in particular, in contravention of the safety requirements of established legislation or specified in this document;
- Use on equipment which does not provide adequate protection against electrocution, water and dust in the actual installation conditions;
- Use on equipment in which dangerous components can be accessed without the use of specific tools;
- Installation/use on equipment which does not comply with established legislation and standards.

Disposal

The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

About the Book

Document Scope

This document describes the Modicon M171 Optimized Logic controllers and accessories including installation and wiring information.

> **NOTE:** Read and understand this document and all related documents, page 9 before installing, operating, or maintaining your controller.

Validity Note

This document has been updated for the release of EcoStruxure Machine Expert - HVACFREE Studio Plus V1.5.0.

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.se.com/ww/en/work/support/green-premium/.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of documentation	Reference number
Modicon M171 Performance Logic Controllers Hardware User Manual	EIO0000002030 (ENG)
	EIO0000002031 (GER)
Modicon M171 Electronic Expansion Valve Drivers User Manual	EIO0000002034 (ENG)
	EIO0000002037 (GER)
SoMachine HVAC software Quick Start	EIO0000002035 (ENG)
SoMachine HVAC software HelpOnLine Manual	EIO0000002036 (ENG)
TM171 Optimized 22 IO Instruction Sheet	EAV96008
TM171 Optimized 14 IO Instruction Sheet	EAV96012
TM171 Optimized Display Instruction Sheet	EAV96016
TM171 Optimized Wall Thermostat Instruction Sheet	EAV96018

You can download these technical publications, the present document and other technical information from our website www.se.com/en/download/.

Product Related Information

⚡⚠ DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH
• Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
• Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
• Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
• Use only the specified voltage when operating this equipment and any associated products.
Failure to follow these instructions will result in death or serious injury.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER
POTENTIAL FOR EXPLOSION
Install and use this equipment in non-hazardous locations only.
Failure to follow these instructions will result in death or serious injury.

⚠ WARNING
LOSS OF CONTROL
• The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
• Separate or redundant control paths must be provided for critical control functions.
• System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
• Observe all accident prevention regulations and local safety guidelines.[1]
• Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

> ### ⚠ WARNING
>
> **UNINTENDED EQUIPMENT OPERATION**
>
> - Only use software approved by Schneider ElectricEliwell for use with this equipment.
> - Update your application program every time you change the physical hardware configuration.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
EN 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2008	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 1088:2008 ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2006	Safety of machinery - Emergency stop - Principles for design
EN/IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2008	Digital data communication for measurement and control: Functional safety field buses.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Overview

M171O Range Overview

M171O Range Overview

General Description

The Modicon M171 Optimized Logic Controller (M171O) range is the compact option in the Schneider Electric platform of programmable controllers, remote displays and accessories, and is dedicated for use in various HVAC&R and other applications.

Modicon M171 Optimized Logic Controller are suitable for customized applications designed to control simple and compacts machines:

- Air/water-cooled chiller
- Rooftop unit
- Heat pump
- Compressor rack
- Ventilation unit

The M171O offer is made of:

- Controllers, page 15
- I/O expansion modules (mixed digital and analog), page 18
- Remote displays, page 19
- Accessories, page 21

The LED remote display references is an exact reproduction of what can be seen on the controller and the large, double LCD remote displays make it even easier to configure and control applications.

Programming Software

In association with the controllers hardware, the SoMachine HVAC (TM171SW) development tool is available to program and customize applications.

You can download SoMachine HVAC (TM171SW) from www.se.com/en/download/document/SoMachine+HVAC+-+Programming+Software+for+Modicon+M171-M172+Logic+Controllers/.

The use of several programming languages in accordance with IEC 61131-3 regulations (programming standard for industrial control), makes it possible to develop new algorithms or entire programs easily, which can then be uploaded to the M171O controllers via a PC and a Programming cable (TM171ADMI) or Programming Stick (TM171AMFK), helping to provide confidentiality with appropriate security.

Downloading parameter maps to controllers is also possible via the TM171AMFK.

For mode information, refer to Data Transfer, page 144.

Controller Range Overview

Type Code

Controller type code

Type code example	Item				
	1	**2**	**3**	**4**	**5**
TM171ODM22R, page 52	TM171O	D	M	22	R

Controller type code description

Item	Description	Description
1	**Product family**	TM171O = Modicon M171 Optimized Logic Controller
2	**Physical feature**	B = Blind
		D = Built-in Display
		F = Flush mounting
3	Optional Modbus SL	None = without Modbus SL
		M = With Modbus SL
4	Number of I/O	14 or 22
5	Digital output type	R = the digital outputs are relay
		S = 2 digital outputs are TRIAC or SSR

TM171O••14R Controllers

Reference	Description	Terminal type
TM171OD14R, page 44	M171 Optimized Display 14 I/Os	Removable screw terminal blocks are provided with the logic controller
TM171ODM14R, page 44	M171 Optimized Display 14 I/Os, Modbus	
TM171OBM14R, page 47	M171 Optimized Blind 14 I/Os, Modbus	

Depending on the references, the TM171O••14R include:

- Up to 2 digital inputs,
- 4 relay outputs,
- Up to 2 PWM/PPM Open Collector analog outputs,
- Up to 2 analog outputs 0…10 Vdc,
- 1 configurable analog outputs 0…20 mA or 4…20 mA.

The Top Hat Section Rail (DIN rail) format provides flexibility and easy installation.

The controller runs on 100…240 Vac power supply.

Delivery Content: The controller is delivered with removable screw terminal blocks.

TM171O••14R Delivery Content

The following figure presents the content of the delivery for a TM171O••14R controller:
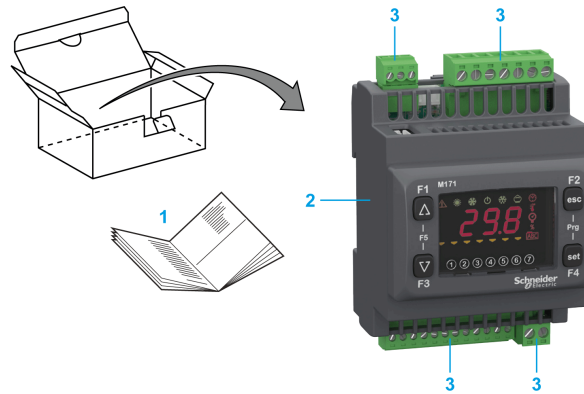
1 TM171O••14R controller Instruction Sheet

2 TM171O••14R controller

3 Removable screw terminal blocks

TM171OD•22R / TM171OB•22R Controllers

Reference	Description	Terminal type
TM171OD22R, page 52	M171 Optimized Display 22 I/Os	Terminal blocks are not provided with the logic controller and must be ordered separately, page 21
TM171ODM22R, page 52	M171 Optimized Display 22 I/Os, Modbus	
TM171ODM22S, page 55	M171 Optimized Display 22 I/Os, Modbus, 2 SSR	
TM171OB22R, page 58	M171 Optimized Blind 22 I/Os	
TM171OBM22R, page 58	M171 Optimized Blind 22 I/Os, Modbus	

Depending on the references, the controllers include:

- 6 digital inputs,
- Up to five relay outputs,
- Up to 2 TRIAC outputs,
- Up to 2 PWM/PPM Open Collector analog outputs,
- Up to 3 analog outputs 0…10 Vdc,
- Up to 2 Open Collector digital outputs for an external relay.

The Top Hat Section Rail (DIN rail) format provides flexibility and easy installation.

The controller runs on 12…24 Vac or 12…24 Vac/24 Vdc power supplies.

TM171OD•22R / TM171OB•22R Delivery Content

The following figure presents the content of the delivery for a TM171OD•22R controller:
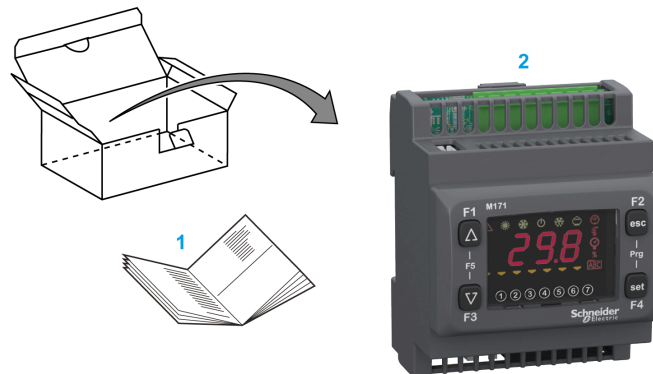
1 TM171OD•22R controller Instruction Sheet

2 TM171OD•22R controller delivered without terminal blocks

TM171OF•22R Flush Mounting Controllers

| Reference	Description	Terminal type
TM171OF22R, page 60	M171 Optimized Flush mounting 22 I/Os	Terminal blocks are not provided with the logic controller and must be ordered separately, page 21
TM171OFM22R, page 60	M171 Optimized Flush mounting 22 I/Os, Modbus	

The controllers include:

- 6 digital inputs,
- Up to 5 relay outputs,
- 2 PWM/PPM analog outputs,
- 3 analog outputs 0…10 Vdc,
- 1 Open Collector digital output for an external relay

The 32x74mm format provides versatility and ease of installation.

The controller runs on 12…24 Vac or 12…24 Vac/24 Vdc power supplies.

TM171OF•22R Delivery Content

The following figure presents the content of the delivery for a TM171OF•22R controller:
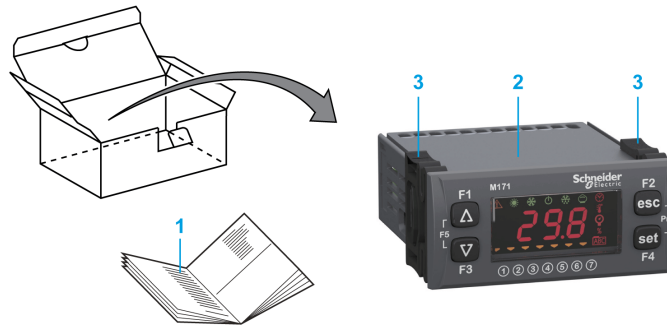
1 TM171OF•22R controller Instruction Sheet

2 TM171OF•22R controller delivered without terminal blocks

3 Two special brackets

Expansion Modules Range Overview

Type Code

Expansion module type code

Type code example	Item		
	1	**2**	**3**
TM171EO22R, page 64	TM171EO	22	R

Expansion module type code description

Item	Description	Description
1	**Product family**	TM171EO = expansion module for Modicon M171 Optimized Logic Controller
2	Number of I/O	14, 15, or 22
3	Digital output type	R = the digital outputs are relay

TM171EO••R Expansion Modules

TM171EO••R expansion modules:

Reference	Description	Compatible controllers
TM171EO14R, page 49	M171 Optimized Expansion 14 I/Os	TM171O••14R
TM171EO15R, page 62	M171 Optimized Expansion 15 I/Os	TM171O••22•
TM171EO22R, page 64	M171 Optimized Expansion 22 I/Os	

TM171EO14R Delivery Content
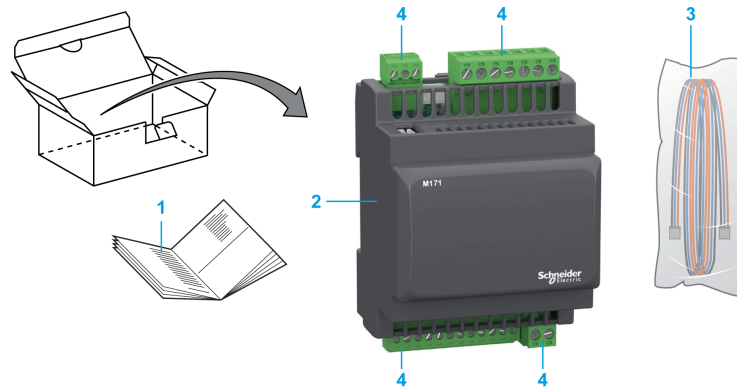
1. **1** TM171EO14R expansion module Instruction Sheet

2 TM171EO14R expansion module delivered with terminal blocks

3 LAN cable (TM171ACB4OLAN)

4 Removable screw terminal blocks

TM171EO15R/TM171EO22R Delivery Content
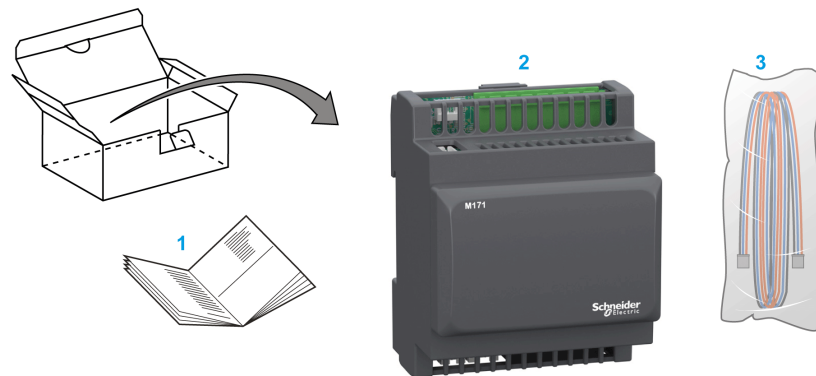
1 TM171EO15R/TM171EO22R expansion module Instruction Sheet

2 TM171EO15R/TM171EO22R expansion module delivered without terminal blocks

3 LAN cable (TM171ACB4OLAN)

Remote Displays Range Overview

Type Code

Remote display type code

Type code example	Item			
	1	**2**	**3**	**4**
TM171DLCD2U, page 98	TM171D	LCD	2	U

Remote display type code description

Item	Description	Description
1	**Product family**	TM171D = remote display for Modicon M171 Optimized Logic Controller
2	**Physical feature**	LED = LED display
		LCD = LCD display
		WAL = LCD display for wall mounting
3	Number of I/O	None, 2
4	Backlight of the LCD Display	U = Display without backlight
		L = Display with backlight

TM171D••••• Remote Displays

Reference	Description	Compatible controllers
TM171DLED, page 97	M171 Optimized Display LED	TM171O•••••
TM171DLCD2U, page 98	M171 Optimized Display LCD	
TM171DWAL2U, page 100	M171 Optimized Wall thermostat without backlight	
TM171DWAL2L, page 100	M171 Optimized Wall thermostat with backlight	

TM171DLED Delivery Content
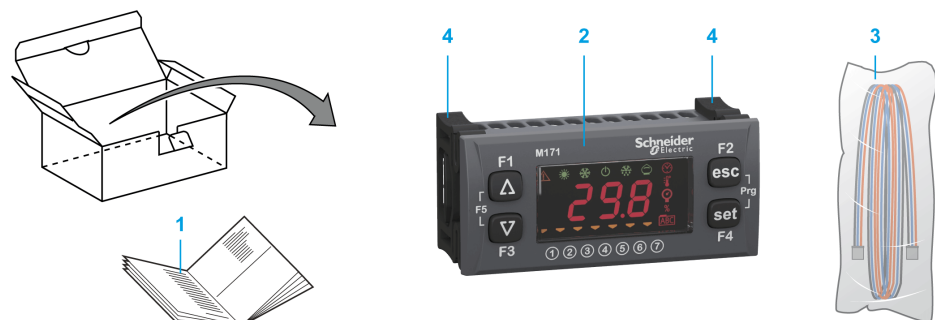
1 TM171DLED remote display Instruction Sheet

2 TM171DLED remote display

3 LAN cable (TM171ACB4OLAN)

4 Two special brackets

TM171DLCD2U Delivery Content

1 TM171DLCD2U remote display Instruction Sheet

2 TM171DLCD2U remote display

3 LAN cable (TM171ACB4OLAN)

TM171DWAL2• Delivery Content

1 TM171DWAL2• remote display Instruction Sheet

2 TM171DWAL2• remote display

3 LAN cable (TM171ACB4OLAN)

Accessories

Overview

This section describes the accessories and cables.

Accessories
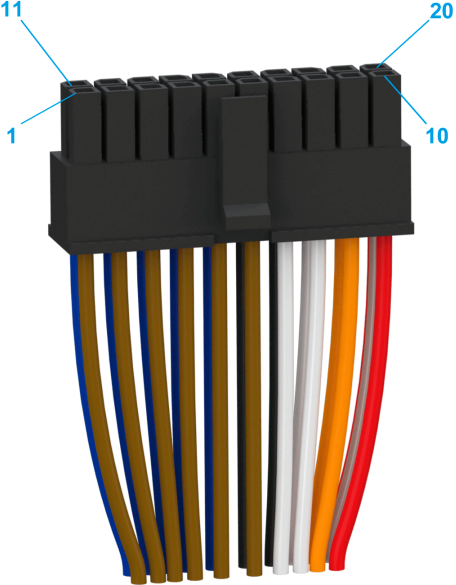
Reference	Description	Use	Length
TM171AMFK	Programming stick	To transfer data from/to the controller	-
TM171ADMI	Programming cable	To connect the PC to the M171O controller ("Yellow cable" is needed)	-
	USB-USB cable		-

Reference	Description	Use	Length
	"Yellow cable": cable (USB connector / 5-pin connector) with one yellow wire	To connect PC (with TM171ADMI programming cable) to the controller. To connect the TM171AMFK programming stick to the controller	-
	"Blue cable": cable (USB connector / 5-pin connector) with one blue wire	To connect PC (with TM171ADMI programming cable) to the TM171AMFK programming stick	-
TM171ACB4O-LAN	Cordset equipped with a 3-pin connector at each end	To connect controller, expansion module, and/or remote display on a LAN network. This cable is a spare part as it is delivered with the expansion modules and remote displays.	2 m / 6.6 ft
TM171AC-B4ORS485	Cordset equipped with a 3-pin connector on one end	To communicate with controller through an RS-485 Modbus SL connection.	1 m / 3.3 ft
TM171AC-B4OAO1M	Cordset equipped with a 4-pin connector on one end	To connect AO3…AO5 analog outputs.	1 m / 3.3 ft
TM171AC-B4OAO2M			2 m / 6.6 ft
TM171AC-B4OI1M	Screw terminal block (pitch 5 mm) with 8 terminals.	The screw terminal is dedicated to digital outputs. For more details, refer to cordset description, page 22.	1 m / 3.3 ft
TM171AC-B4OI2M	Cordset equipped with a 20-pin connector on one end		2 m / 6.6 ft
TM171ABKPB	White backplate kit for wall mounting	Wall mounting of TM171DLCD2U remote display	-
TM171ABKPG	Black backplate kit for wall mounting		-

TM171ACB4OI1M / TM171ACB4OI2M Cordset Description

The following table provides description of the TM171ACB4OI1M / TM171ACB4OI2M 20-pin connectors with free wires:

Pin Number		Wire Color	Dedicated to
	1…6	Brown	Digital inputs
	7, 8	White	I/O (depending on the device)
	9	Orange	Auxiliary supply
	10	Red	Power supply
	11…15	Blue	Analog inputs
	16, 17	Black	GND
	18	White	I/O (depending on the device)
	19	Orange	Auxiliary supply
	20	Grey	Power supply

Maximum Hardware Configuration

Overview

The M171O devices can be connected through the LAN expansion bus.

You can connect:

- 1 controller (TM171O••14R or TM171O••22•)
- 1 expansion module (TM171EO••R) compatible with the controller
- 1 TM171DLED LED remote display
- 1 additional LCD remote display (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U)

Controllers / Expansion Modules Compatibilities

M171O controller/expansion module compatibility:

Controller	Expansion Module
TM171OBM14R TM171OD14R TM171ODM14R	TM171EO14R
TM171OB22R TM171OBM22R TM171OD22R TM171ODM22R TM171ODM22S TM171OF22R TM171OFM22R	TM171EO15R TM171EO22R

Controllers / Remote Displays Compatibility

The LED remote display (TM171DLED) is compatible with all M171O controllers.

The LCD remote displays (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U) are compatible with the M171O controllers but only one additional LCD remote display can be connected to a controller.

Maximum Architecture Example
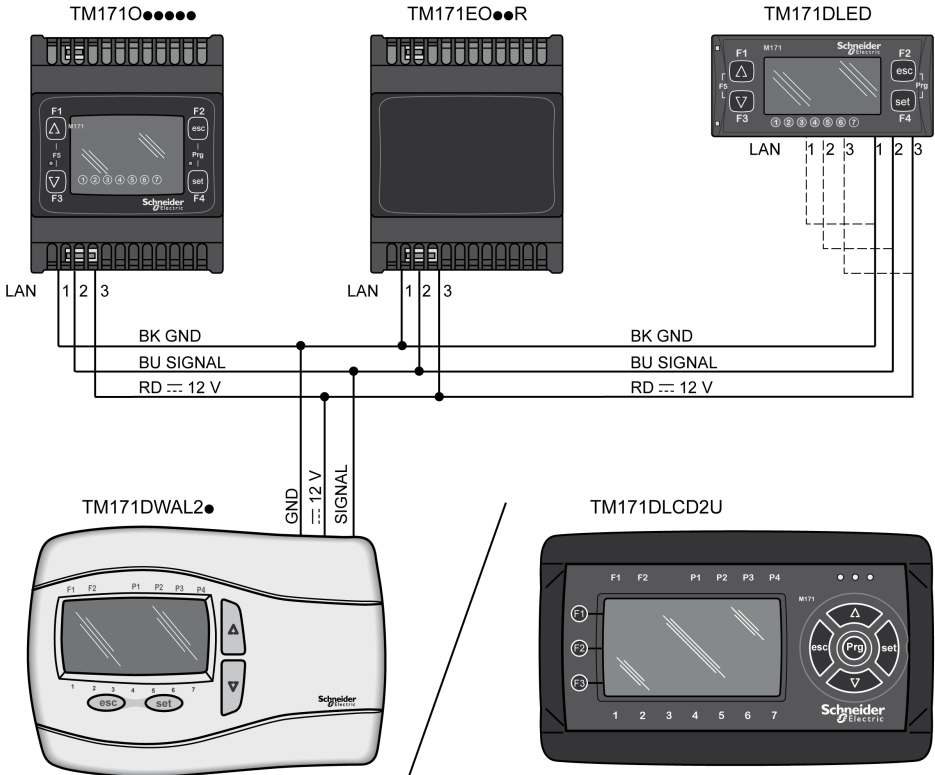
NOTE: The total LAN expansion bus length must not exceed 100 m (328 ft).

Only one LCD remote display (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U) can be connected to the LAN expansion bus.

To connect 2 devices together, use the LAN cable delivered with remote display or expansion module or order it separately (TM171ACB4OLAN).

To connect more devices, use the suitable cables and connector devices.

Installation

Before Starting

Before Starting

Read and understand this chapter before beginning the installation of your system.

Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your machine or process in the use of this equipment.

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, you must also consider any applicable local, regional or national standards and/or regulations.

⚠WARNING
REGULATORY INCOMPATIBILITY
Ensure that all equipment applied and systems designed comply with all applicable local, regional, and national regulations and standards.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Disconnecting Power

All options and modules should be assembled and installed before installing the control system on a mounting rail, onto a mounting plate or in a panel. Remove the control system from its mounting rail, mounting plate or panel before disassembling the equipment.

⚡⚠DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH
• Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
• Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
• Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
• Use only the specified voltage when operating this equipment and any associated products.
Failure to follow these instructions will result in death or serious injury.

Programming Considerations

The products described in this manual have been designed and tested using Schneider Electric programming, configuration, and maintenance software products.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider ElectricEliwell for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Operating Environment

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the conditions described in the Environmental Characteristics.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Installation Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment and secured by a keyed or tooled locking mechanism.
- Use the sensor and actuator power supplies only for supplying power to the sensors or actuators connected to the module.
- Power line and output circuits must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular equipment.
- Do not use this equipment in safety-critical machine functions unless the equipment is otherwise designated as functional safety equipment and conforming to applicable regulations and standards.
- Do not disassemble, repair, or modify this equipment.
- Do not connect any wiring to unused connections, or to connections designated as No Connection (N.C.).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: JDYX2 or JDYX8 fuse types are UL-recognized and CSA approved.

The M171O controllers are intended for Top Hat Section Rail (DIN rail) mounting, panel mounting, or wall mounting.

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are exceptionally vulnerable to electrostatic discharge.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent casual access and provide electrostatic discharge protection.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For more information about enclosures, refer to the definition found in IEC 1000-4-2.

Wiring Best Practices

Wiring Best Practices

The following information describes the wiring guidelines and associated best practices to be respected when using a Modicon M171 Optimized Logic Controller.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

Wiring Guidelines

The following rules must be applied when wiring M171O controllers:

- I/O and communication wiring must be kept separate from the power wiring. Route these two types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.

- Use copper conductors (required).
- Use twisted pair, shielded cables for analog, and/or fast I/O.
- Use twisted pair, shielded cables for networks, and fieldbus.

Use shielded, properly grounded cables for all analog and high-speed inputs or outputs and communication connections. If you do not use shielded cable for these connections, electromagnetic interference can cause signal degradation. Degraded signals can cause the controller or attached modules and equipment to perform in an unintended manner.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables for all fast I/O, analog I/O and communication signals.
- Ground cable shields for all analog I/O, fast I/O and communication signals at a single point[1].
- Route communication and I/O cables separately from power cables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

---

[1] Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

NOTE: Surface temperatures may exceed 60 °C (140 °F). Route primary wiring (wires connected to power mains) separately and apart from secondary wiring (extra low voltage wiring coming from intervening power sources). If that is not possible, double insulation is required such as conduit or cable gains.

Rules for Screw Terminal Block

The following table presents the cable types and wire sizes for a 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.) pitch screw terminal block:

mm / in. (7 / 0.28)								
mm²	0.2…2.5	0.2…2.5	0.25…2.5	0.25…2.5	2 x 0.2…1	2 x 0.2…1.5	2 x 0.25…1	2 x 0.5...1.5
AWG	24…14	24…14	22…14	22…14	2 x 24…18	2 x 24…16	2 x 22…18	2 x 20...16

Ø 3,5 mm (0.14 in.)	
N•m	0.5...0.6
lb-in	4.42...5.31

The following table presents the cable types and wire sizes for a 3.81 mm (0.15 in.) or 3.50 mm (0.14 in.) pitch screw terminal block:

mm / in. (9 / 0.35)								
mm²	0.14…1.5	0.14…1.5	0.25…1.5	0.25…0.5	2 x 0.08…0.5	2 x 0.08…0.75	2 x 0.25…0.34	2 x 0.5
AWG	26…16	26…16	22…16	22…20	2 x 28…20	2 x 28…20	2 x 24…22	2 x 20

Ø 2,5 mm (0.1 in.)	N•m	0.22...0.25
	lb-in	1.95...2.21

The use of copper conductors is required.

⚠⚠DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

- Tighten connections in conformance with the torque specifications.
- Do not insert more than one wire per connector of the terminal block unless using the cable ends (ferrules) specified above.

Failure to follow these instructions will result in death or serious injury.

⚠WARNING

FIRE HAZARD

- Use only the recommended wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output wiring of 2 A, use conductors of at least 0.5 mm² (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For relay output wiring of 3 A, use conductors of at least 1.5 mm² (AWG 16) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring of 8 A, or relay output wiring greater than 3 A, use conductors of at least 2.0 mm² (AWG 12) with a temperature rating of at least 80 °C (176 °F).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the relay outputs. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

⚠CAUTION

OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage.

Failure to follow these instructions can result in injury or equipment damage.

Choose a protection circuit from the following diagrams according to the power supply used. Connect the protection circuit to the outside of the controller or relay output module.

If your controller or module contains relay outputs, these types of outputs can support up to 240 Vac. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must include a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

⚠WARNING

RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

Failure to follow these instructions can result in death, serious injury, or equipment damage.
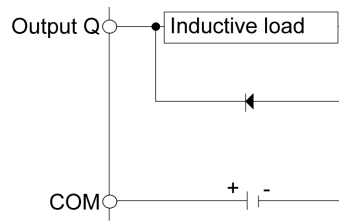
Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.
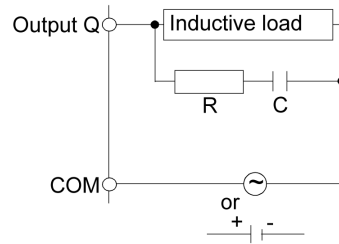
C Value from 0.1 to 1 µF

R Resistor of approximately the same resistance value as the load

Protective circuit B: this protection circuit can be used for DC load power circuits.

Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.
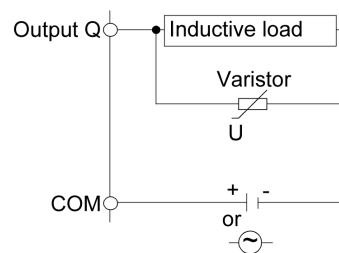
In applications where the inductive load is switched on and off frequently and/or rapidly, verify that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.

NOTE: Place protection devices as close to the load as possible.

Special Handling Considerations

Care must be taken to avoid damage from electrostatic sources when handling this equipment. In particular exposed connectors and, in some cases, exposed printed circuit boards are exceptionally vulnerable to electrostatic discharge.

<div style="border:1px solid black">

⚠WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO ELECTROSTATIC DISCHARGE DAMAGE

- Keep equipment in the protective conductive packaging until you are ready to install the equipment.
- Only install equipment in approved enclosures and / or locations that prevent casual access and provide electrostatic discharge protection.
- Use a conductive wrist strap or equivalent field force protective device attached to an earth ground when handling sensitive equipment.
- Always discharge yourself by touching a grounded surface or approved antistatic mat before handling the equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

</div>

For more information about enclosures, refer to the definition found in IEC 1000-4-2.

Analog Inputs-Probes

Temperature probes have no connection polarity and can be extended using a normal bipolar cable.

> **NOTE:** The extension of the probes wiring influences the electromagnetic compatibility (EMC) of the instrument

> **NOTE:** Check the polarity for probes which have a specific connection polarity.

<div style="border:1px solid black">

NOTICE

INOPERABLE EQUIPMENT

Verify all wiring connections before applying power.

Failure to follow these instructions can result in equipment damage.

</div>

> **NOTE:** Do not power any connected devices that are externally powered without also applying power to the M171O.

<div style="border:1px solid black">

NOTICE

INOPERABLE EQUIPMENT

Ensure that the controller has power applied when applying power to other connected and externally powered devices.

Failure to follow these instructions can result in equipment damage.

</div>

> **NOTE:** Signal leads (probes, digital inputs, communication, and the electronic supply) must be routed separately from power cables.

Controllers and Expansion Modules

What's in This Part

Environmental Characteristics

What's in This Chapter

Technical Data

The Modicon M171 Optimized Logic Controller system components meet European Community (CE) requirements for open equipment. You must install them in an enclosure or other location designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Use metal enclosures to improve the electromagnetic immunity of your M171O system. This equipment meets CE requirements as indicated in the following tables.

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
Do not exceed any of the rated values specified within this chapter.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Environmental

Controller and Expansion Modules Specifications

Characteristics	Specification	Controller						Expansion module		
		TM171O••14R	TM171OB22R	TM171OBM22R	TM171OD•22R	TM171OF•22R	TM171ODM22S	TM171EO14R	TM171EO15R	TM171EO22R
Product certifications	CE, CSA, cURus, EAC, RCM, RoHS China				✓					
IP degree of protection	IP20				✓					
Intended Use	Electric automatic control (not safety) for incorporation				✓					
Purpose of Device	HVAC applications			✓					-	
	I/O expansion module for M171O controller			-					✓	
Mounting	Top Hat Section Rail (DIN rail)		✓			-	✓		✓	
	Flush mounting		-			✓	-		-	
Type of action	1.B				✓					
	1. Y			✓					-	
Pollution class	2 (normal)				✓					
Insulation material group	IIIa				✓					
Over-voltage category	II				✓					
Nominal pulse voltage	2500 V				✓					
Digital outputs	Refer to the label on the device				✓					

Characteristics	Specification	Controller						Expansion module		
		TM171O••14R	TM171OB22R	TM171OBM22R	TM171OD•22R	TM171OF•22R	TM171ODM22S	TM171EO14R	TM171EO15R	TM171EO22R
Period of electric stress on the insulating parts	Long period	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ambient operating temperature	-20…55 °C (-4…131 °F)	✓	✓	✓	✓	✓	-	✓	✓	✓
	-20…65 °C (-4…149 °F)	-	-	-	-	-	✓	-	-	-
Ambient operating humidity (non-condensing)	10…90 %	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ambient storage temperature	-40…85 °C (-40…185 °F)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ambient storage humidity (non-condensing)	10…90 %	✓	✓	✓	✓	✓	✓	✓	✓	✓
Power supply	100…240 Vac (Isolated) 50 Hz / 60 Hz	✓	-	-	-	-	-	✓	-	-
	12…24 Vac (+/- 10 %) (not isolated) 50 Hz / 60 Hz	-	✓	✓	✓	✓	✓	-	✓	✓
	24 Vdc (+/- 10 %) (not isolated)	-	✓	✓	✓	✓	-	-	-	✓
Consumption	6 VA	✓	-	-	-	-	✓	✓	-	-
	4 VA / 3 W	-	✓	-	-	-	-	-	✓	-
	6 VA / 4 W	-	-	✓	✓	✓	-	-	-	✓
Insulation class	II	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fire-resistance category	D	✓	✓	✓	✓	✓	✓	✓	✓	✓
Software class	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Type of disconnection for each circuit	Micro disconnection	✓	✓	✓	✓	✓	✓	✓	✓	✓

Installation

What's in This Chapter

TM171OD•••• / TM171OB•••• / TM171EO••R Mounting Positions and Clearances

Presentation

This section describes the mounting positions for the TM171OD•••• / TM171OB•••• controllers and the TM171EO••R expansion modules.

Correct Mounting Position

Whenever possible, the TM171OD•••• / TM171OB•••• controllers and the TM171EO••R expansion modules should be mounted horizontally on a vertical plane as shown in the figure below:
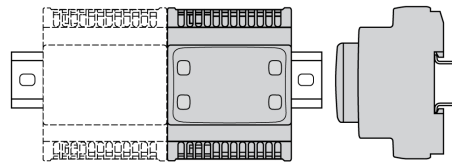
Acceptable Mounting Position

The TM171OD•••• / TM171OB•••• controllers and the TM171EO••R expansion modules can also be mounted vertically with a temperature derating on a vertical plane as shown below:
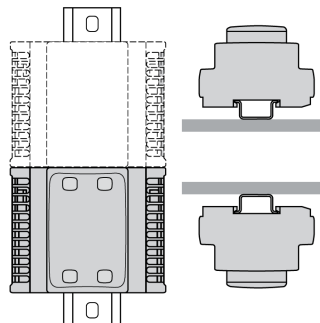
NOTE: In these positions, some environmental characteristics are not reached. For more details on usage limitations, contact Schneider Electric Customer Care Center.

Minimum Clearances

> ## ⚠ **WARNING**
>
> **UNINTENDED EQUIPMENT OPERATION**
>
> - Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
> - Avoid placing this equipment next to or above devices that might cause overheating.
> - Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
> - Install all equipment in accordance with the specifications in the related documentation.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The TM171OD•••• / TM171OB•••• controllers and the TM171EO••R expansion modules have been designed as IP20 products and must be installed in an enclosure appropriately rated for its intended environment and secured by a keyed or tooled locking mechanism.

There are 3 types of clearances between:

- The M171O device and the sides of the cabinet (including the panel door).
- The M171O device terminal blocks and the wiring ducts. This distance reduces electromagnetic interference between the controller and the wiring ducts.
- The M171O device and other heat generating devices installed in the same cabinet.

The following figure shows the minimum clearances that apply to the TM171OD•••• / TM171OB•••• / TM171EO••R references:
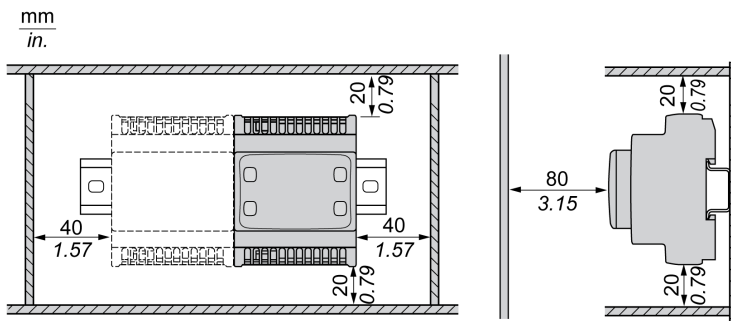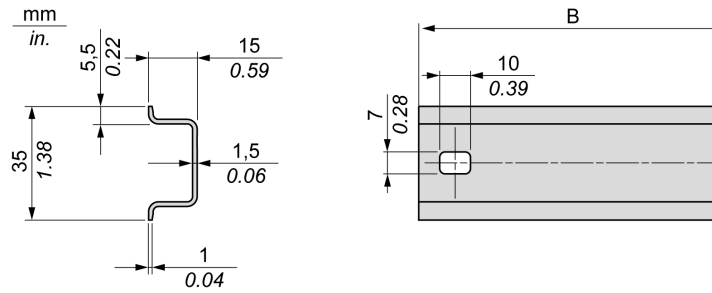

Top Hat Section Rail (DIN Rail)

Dimensions of Top Hat Section Rail (DIN Rail)

You can mount the controller and expansion module on a 35 mm (1.38 in.) top hat section rail (DIN rail). It can be attached to a smooth mounting surface or suspended from a EIA rack or mounted in a NEMA cabinet.
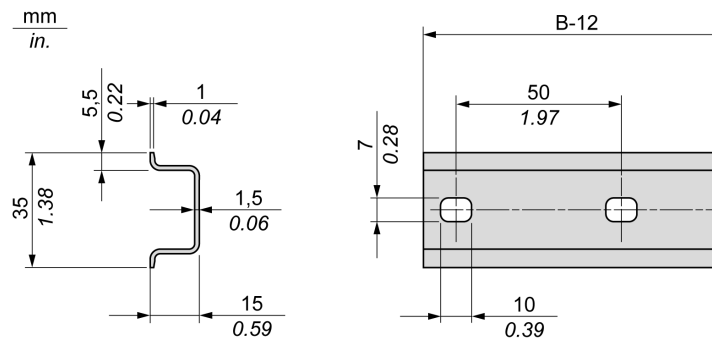
Symmetric Top Hat Section Rails (DIN Rail)

The following illustration and table show the references of the top hat section rails (DIN rail) for the wall-mounting range:
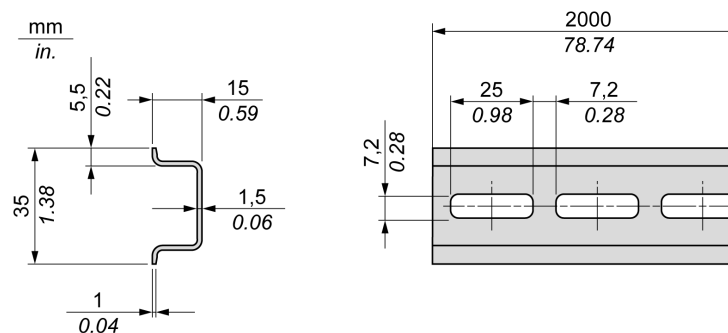

Reference	Type	Rail length (B)
NSYSDR50A	A	450 mm (17.71 in.)
NSYSDR60A	A	550 mm (21.65 in.)
NSYSDR80A	A	750 mm (29.52 in.)
NSYSDR100A	A	950 mm (37.40 in.)

The following illustration and table show the references of the symmetric top hat section rails (DIN rail) for the metal enclosure range:

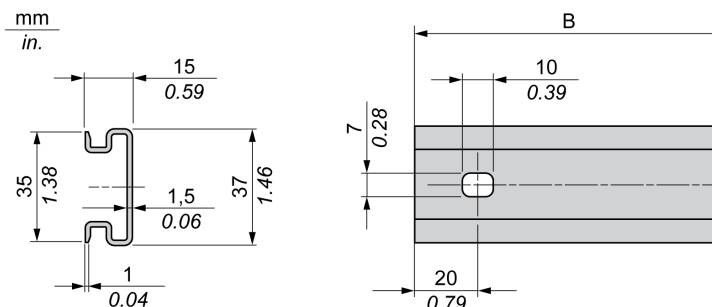| Reference	Type	Rail length (B-12 mm)
NSYSDR60	A	588 mm (23.15 in.)
NSYSDR80	A	788 mm (31.02 in.)
NSYSDR100	A	988 mm (38.89 in.)
NSYSDR120	A	1188 mm (46.77 in.)

The following illustration and table shows the references of the symmetric top hat section rails (DIN rail) of 2000 mm (78.74 in.):

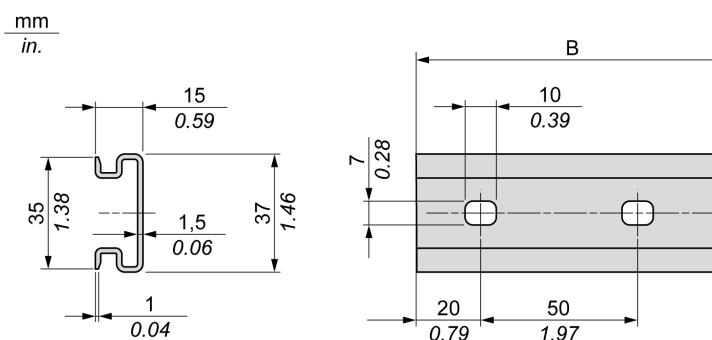| Reference	Type	Rail length
NSYSDR200[1]	A	2000 mm (78.74 in.)
NSYSDR200D[2]	A	
1 Unperforated galvanized steel		
2 Perforated galvanized steel		

Double-Profile Top Hat Section Rails (DIN Rail)

The following illustration and table show the references of the double-profile top hat section rails (DIN rails) for the wall-mounting range:

Reference	Type	Rail length (B)
NSYDPR25	W	250 mm (9.84 in.)
NSYDPR35	W	350 mm (13.77 in.)
NSYDPR45	W	450 mm (17.71 in.)
NSYDPR55	W	550 mm (21.65 in.)
NSYDPR65	W	650 mm (25.60 in.)
NSYDPR75	W	750 mm (29.52 in.)

The following illustration and table show the references of the double-profile top hat section rails (DIN rail) for the floor-standing range:

| Reference	Type	Rail length (B)
NSYDPR60	F	588 mm (23.15 in.)
NSYDPR80	F	788 mm (31.02 in.)
NSYDPR100	F	988 mm (38.89 in.)
NSYDPR120	F	1188 mm (46.77 in.)

TM171OF•22R Mounting Positions and Clearances

Presentation

This section describes the mounting positions for the TM171OF•22R controllers.

Correct Mounting Position

The TM171OF•22R controllers must be mounted horizontally on a vertical panel as shown in the figure below:
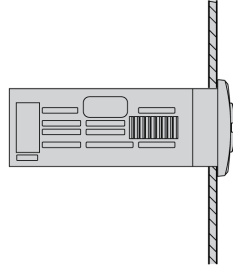
Minimum Clearances

| ⚠ **WARNING** |
| --- |
| **UNINTENDED EQUIPMENT OPERATION** |
| • Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation. |
| • Avoid placing this equipment next to or above devices that might cause overheating. |
| • Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document. |
| • Install all equipment in accordance with the specifications in the related documentation. |
| **Failure to follow these instructions can result in death, serious injury, or equipment damage.** |

The TM171OF•22R controllers have been designed as IP20 products and must be installed in an enclosure appropriately rated for its intended environment and secured by a keyed or tooled locking mechanism.

There are 3 types of clearances between:

• The TM171OF•22R device and the sides of the cabinet (including the panel door).
• The TM171OF•22R device terminal blocks and the wiring ducts. This distance reduces electromagnetic interference between the controller and the wiring ducts.
• The TM171OF•22R device and other heat generating devices installed in the same cabinet.

The following figure shows the minimum clearances that apply to the TM171OF•22R references:
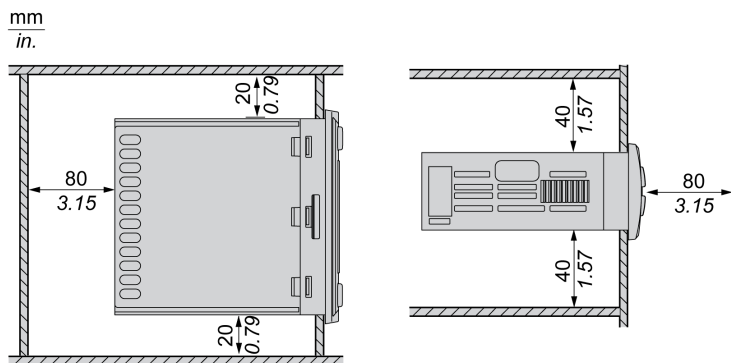
# TM171OD•••• / TM171OB•••• / TM171EO••R Installation

Overview

This section describes how to install and remove the TM171OD•••• / TM171OB•••• controllers and the TM171EO••R expansion modules from a top hat section rail (DIN rail).

Installing on a Top Hat Section Rail (DIN Rail)

The following procedure describes how to install a controller or an expansion module on a top hat section rail (DIN rail):

Step	Action
1	Move the two spring docking devices to their standby position (use a screwdriver to press against the relative compartments).
2	Position the top groove of the controller or the expansion modules on the top edge of the Top Hat Section Rail (DIN rail).
3	Press the assembly against the Top Hat Section Rail (DIN rail).
4	Press the spring docking devices to put them into the locked position.
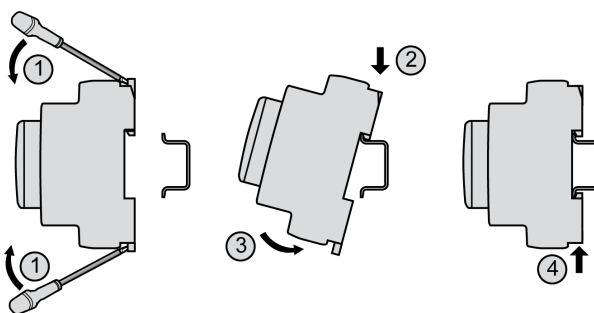
Removing from a Top Hat Section Rail (DIN Rail)

The following procedure describes how to remove a controller or an expansion module from a top hat section rail (DIN rail):

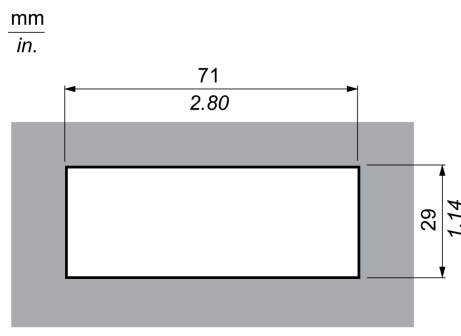| Step	Action
1	Remove all power from the controller or the expansion module.
2	Insert a flat screwdriver into the spring docking devices.
3	Pull down the spring docking device to move it to its standby position.
4	Pull the controller or the expansion module from the top hat section rail (DIN rail) from the bottom.

TM171OF•22R Direct Mounting on a Panel Surface

Overview

This section shows how to install TM171OF•22R controllers using the special brackets provided. This section also provides mounting hole layout.
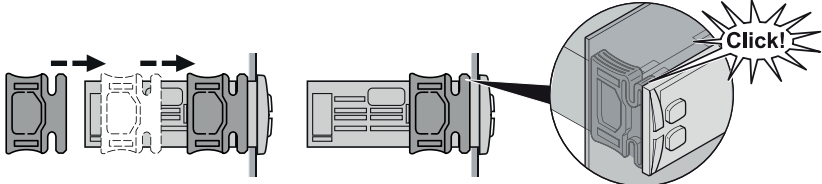
Mounting Hole Layout

The following diagram shows the mounting hole layout for TM171OF•22R controllers:

NOTE: The maximum thickness must not exceed 9 mm (0.35 in).

Installing TM171OF•22R on Panel

The following procedure shows how to install TM171OF•22R:

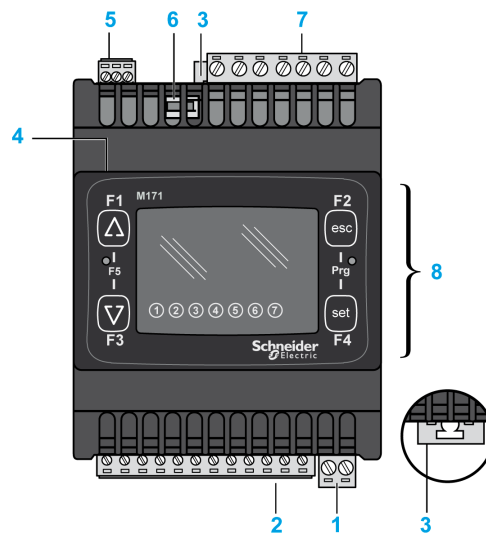| Step	Action
1	Make a 29x71 mm (1.14 x 2. 80 in) hole using the mounting hole layout.
2	Insert the device.
3	Secure it with the special brackets provided:

Device Description TM171•••14R

What's in This Chapter

TM171OD14R / TM171ODM14R

Physical Description

The following illustration presents a TM171OD14R / TM171ODM14R controller:

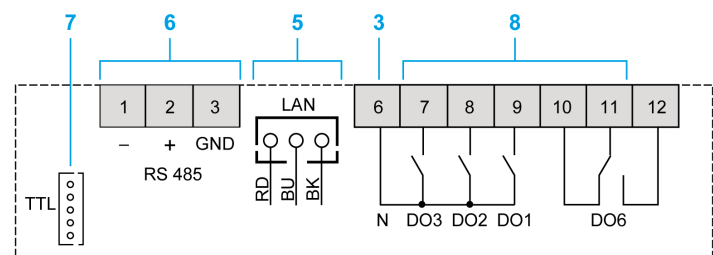| Number	Description
1	100…240 Vac power supply connector with removable terminal block
2	Input/output connector with removable terminal block
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	TTL programming port
5	RS-485 serial port [1]
6	LAN expansion bus port
7	Digital output connector with removable terminal block
8	User interface, page 108

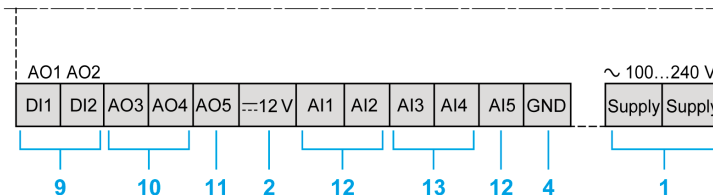| (1)	Only for TM171O•M•••.

NOTE: The controller is delivered with removable screw terminal blocks, page 67.

Connectors Description

Top view:

Bottom view:

Num-ber	Description	
1	100…240 Vac isolated power supply, page 69	
2	12 Vdc auxiliary supply, 70 mA maximum	
3	N: Common for digital output	
4	GND: Ground	
5	LAN expansion bus port, page 82	
6	RS-485 serial port, page 84 [2]	
7	TTL programming port, page 86	
8	DO1...DO3, DO6	High voltage relay digital output, page 75
9	Configurable as: • AO1, AO2 • DI1, DI2	Configurable as: • Low voltage (SELV) analog output: Open Collector PWM/PPM, page 80 • Dry contact digital input, page 73
10	AO3, AO4	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
11	AO5	Low voltage (SELV) analog outputs configurable as: • 0…20 mA, page 81 • 4…20 mA, page 81
12	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Pt1000 analog input, page 77 [1] • Dry contact digital input, page 73

Num-ber	Description	
13	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

(1)	If any input AI1, AI2, AI5 is set as Pt1000, then all three AIs are set by hardware as Pt1000. Nevertheless, these inputs can still be configured as "Not connected" or "Digital input" by software using parameters, page 125.
(2)	Only for TM171O•M•••.

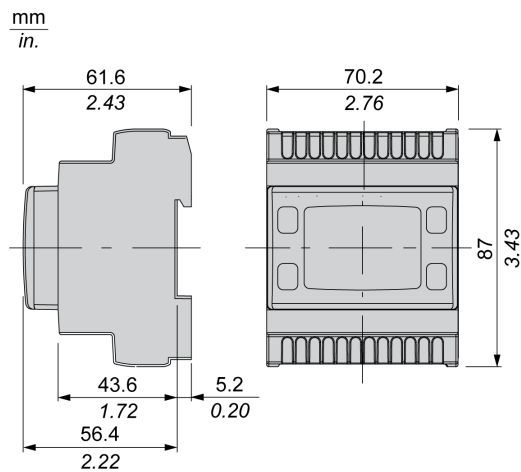| *NOTICE* |
|---|
| **INOPERABLE EQUIPMENT** |
| Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected. |
| **Failure to follow these instructions can result in equipment damage.** |

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

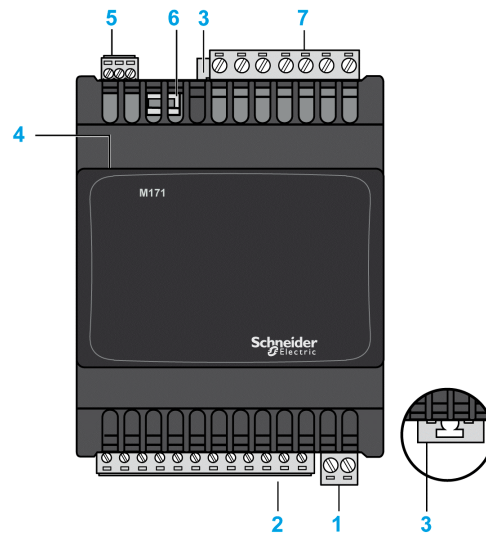For more information about the wiring, refer to wiring best practices, page 29.

Dimension

TM171OBM14R

Physical Description

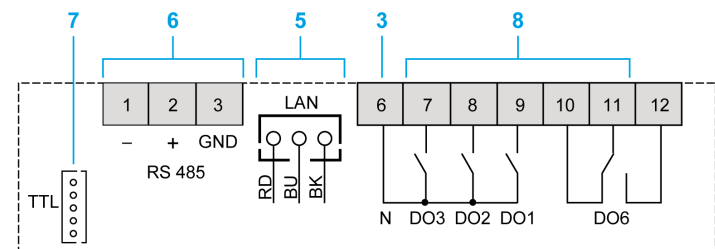The following illustration presents a TM171OBM14R controller:

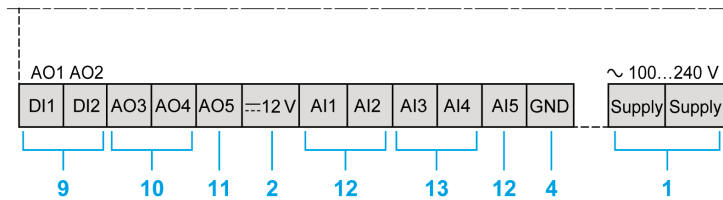| Number	Description
1	100…240 Vac power supply connector with removable terminal block
2	Input/output connector with removable terminal block
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	TTL programming port
5	RS-485 serial port
6	LAN expansion bus port
7	Digital output connector with removable terminal block

NOTE: The controller is delivered with removable screw terminal blocks, page 67.

Connectors Description

Top view:

Bottom view:

Num-ber	Description	
1	100…240 Vac isolated power supply, page 69	
2	12 Vdc auxiliary supply, 70 mA maximum	
3	N: Common for digital output	
4	GND: Ground	
5	LAN expansion bus port, page 82	
6	RS-485 serial port, page 84	
7	TTL programming port, page 86	
8	DO1...DO3, DO6	High voltage relay digital output, page 75
9	Configurable as: • AO1, AO2 • DI1, DI2	Configurable as: • Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80 • Dry contact digital input, page 73
10	AO3, AO4	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
11	AO5	Low voltage (SELV) analog outputs configurable as: • 0…20 mA, page 81 • 4…20 mA, page 81
12	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Pt1000 analog input, page 77 [1] • Dry contact digital input, page 73
13	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

(1)	If any input AI1, AI2, AI5 is set as Pt1000, then all three AIs are set by hardware as Pt1000. Nevertheless, these inputs can still be configured as "Not connected" or "Digital input" by software using parameters, page 125.

NOTICE

INOPERABLE EQUIPMENT
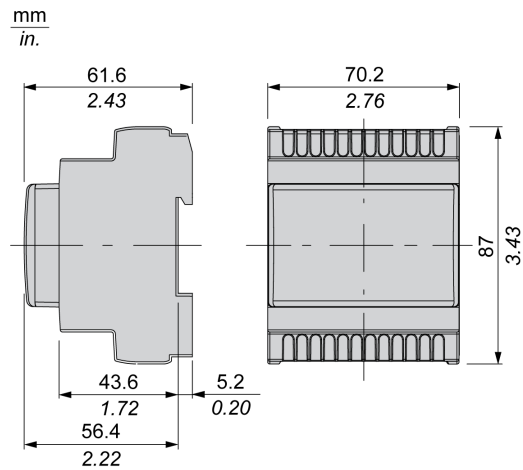
Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.
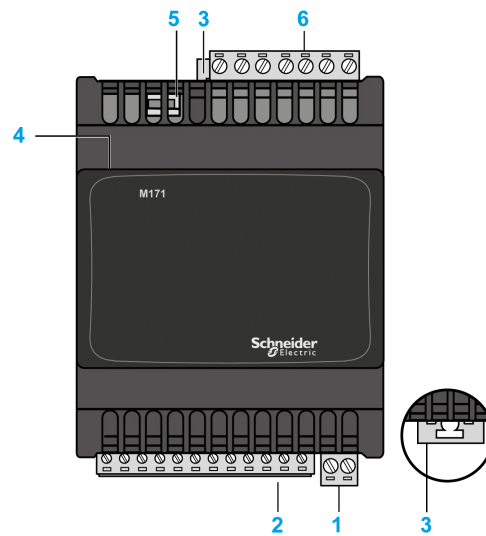
Dimension

TM171EO14R

Physical Description

The following illustration presents a TM171EO14R expansion module:

Number	Description
1	100…240 Vac power supply connector with removable terminal block
2	Input/output connector with removable terminal block
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	TTL programming port
5	LAN expansion bus port
6	Digital output connector with removable terminal block

NOTE: The expansion module is delivered with removable screw terminal blocks, page 67 and a LAN expansion cable.

Connectors Description

Top view:

Bottom view:

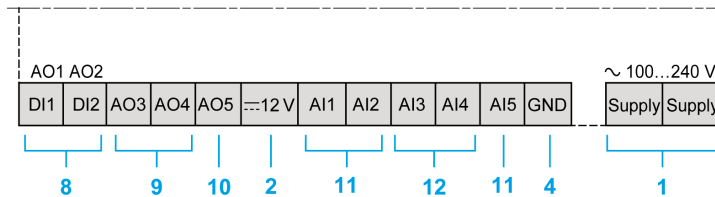| Num-ber	Description	
1	100…240 Vac isolated power supply, page 69	
2	12 Vdc auxiliary supply, 70 mA maximum	
3	N: Common for digital output	
4	GND: Ground	
5	LAN expansion bus port, page 82	
6	TTL programming port, page 86	
7	DO1...DO3, DO6	High voltage relay digital output, page 75
8	Configurable as: • AO1, AO2 • DI1, DI2	Configurable as: • Low voltage (SELV) analog outputs: Open Collector PPM, page 80 • Dry contact digital input, page 73
9	AO3, AO4	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
10	AO5	Low voltage (SELV) analog outputs configurable as: • 0…20 mA, page 81 • 4…20 mA, page 81
11	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
13	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

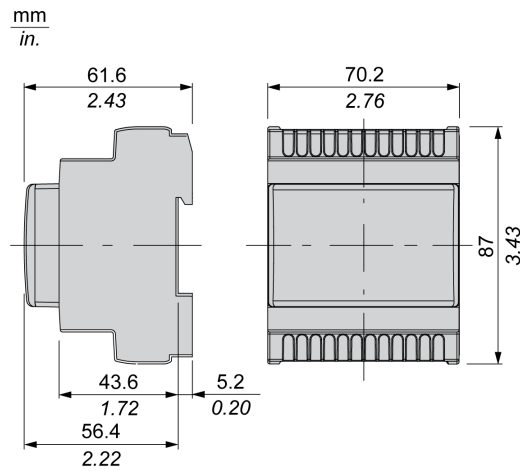| NOTICE |
|---|
| **INOPERABLE EQUIPMENT** |
| Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected. |
| **Failure to follow these instructions can result in equipment damage.** |

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

Dimension

Device Description TM171•••22• / TM171EO15R

What's in This Chapter

TM171OD22R / TM171ODM22R

Physical Description

The following illustration presents a TM171OD22R / TM171ODM22R controller:

Number	Description
1	12…24 Vac or 24 Vdc power supply
2	Input/output connector
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	Analog output connector
5	LAN expansion bus port
6	TTL programming port
7	RS-485 serial port [1]
8	Digital output connector
9	User interface, page 108

(1)	Only for TM171O•M•••.

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Top view:

Bottom view:

Num- ber	Description	
1	12…24 Vac or 24 Vdc power supply, page 69	
2	5 Vdc auxiliary supply, 20 mA maximum	
3	12 Vdc auxiliary supply, 70 mA maximum	
4	N: Common for digital output	
5	GND: Ground	
6	LAN expansion bus port, page 82	
7	RS-485 serial port, page 84 (1)	
8	TTL programming port, page 86	
9	DO1…DO4, DO6	High voltage relay digital output, page 75
10	AO1, AO2	Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80
11	AO3…AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
12	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
13	DI1…DI6	Dry contact digital input, page 73
14	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73

Num-ber	Description	
15	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

(1)	Only for TM171O•M•••.

NOTICE

INOPERABLE EQUIPMENT

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

Dimension

TM171ODM22S

Physical Description

The following illustration presents a TM171ODM22S controller:

Number	Description
1	12…24 Vac power supply
2	Input/output connector
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	Analog output connector
5	LAN expansion bus port
6	Programming port TTL
7	RS-485 serial port
8	Digital output connector
9	User interface, page 108

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Top view:

Bottom view:

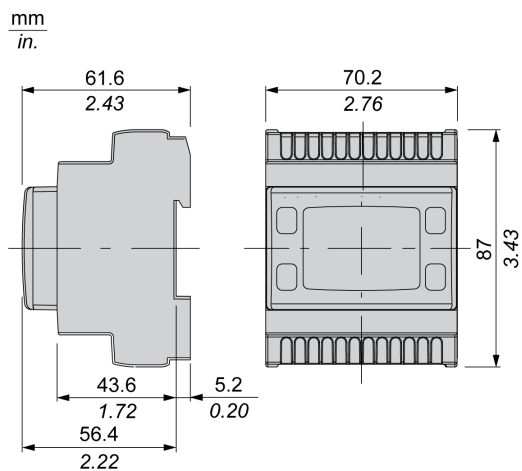| Num-ber	Description	
1	12…24 Vac power supply, page 69	
2	5 Vdc auxiliary supply, 20 mA maximum	
3	12 Vdc auxiliary supply, 70 mA maximum	
4	N: Common for digital output	
5	GND: Ground	
5	LAN expansion bus port, page 82	
7	RS-485 serial port, page 84)	
8	TTL programming port, page 86	
9	DO1…DO3	High voltage relay digital outputs, page 75
10	DO4	Low voltage (SELV) digital outputs: Open Collector, page 74
11	TC1, TC2	High voltage TRIAC outputs, page 76
12	AO1	Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80
13	AO3…AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
14	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
15	DI1…DI6	Dry contact digital input, page 73
16	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
17	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

NOTICE

INOPERABLE EQUIPMENT

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

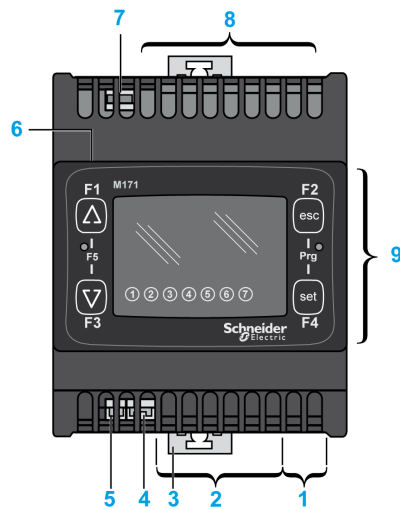For more information about the wiring, refer to wiring best practices, page 29.

Ground
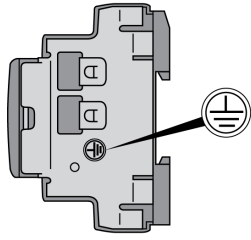
⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK

The grounding connection on the side of the device must be used to provide a protective ground at all times.

Failure to follow these instructions will result in death or serious injury.

Dimension
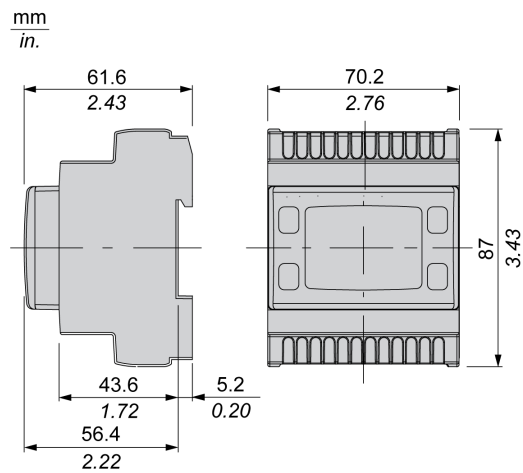
TM171OB22R / TM171OBM22R

Physical Description

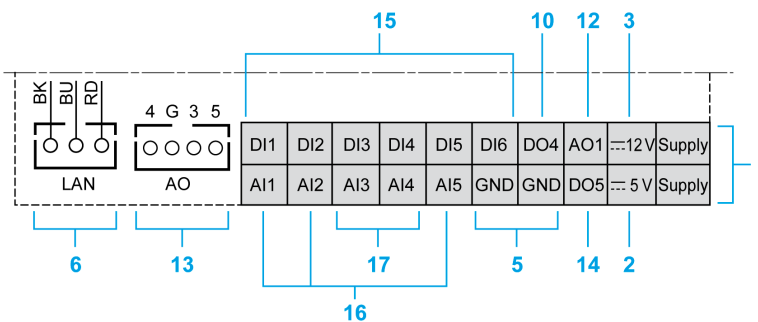The following illustration presents a TM171OB22R / TM171OBM22R controller:

Number	Description
1	12…24 Vac or 24 Vdc power supply
2	Input/output connector
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	Analog output connector
5	LAN expansion bus port
6	RS-485 serial port (1)
7	TTL programming port
8	Digital output connector

(1)	Only for TM171O•M•••.

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Top view:

Bottom view:

Num-ber	Description	
1	12…24 Vac or 24 Vdc power supply, page 69	
2	5 Vdc auxiliary supply, 20 mA maximum	
3	12 Vdc auxiliary supply, 70 mA maximum	
4	N: Common for digital output	
5	GND: Ground	
6	LAN expansion bus port, page 82	
7	RS-485 serial port, page 84 [1]	
8	TTL programming port, page 86	
9	DO1…DO4, DO6	High voltage relay digital outputs, page 75
10	AO1, AO2	Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80
11	AO3…AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
12	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
13	DI1…DI6	Dry contact digital input, page 73
14	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
15	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

| (1)	Only for TM171O•M•••.

NOTICE

INOPERABLE EQUIPMENT

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

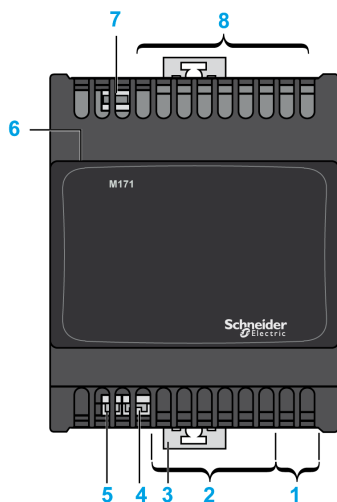# Dimension

TM171OF22R / TM171OFM22R

Physical Description

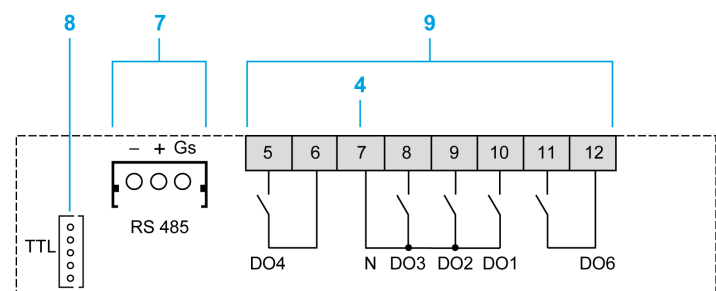The following illustration presents a TM171OF22R / TM171OFM22R controller:

Front view   Rear view
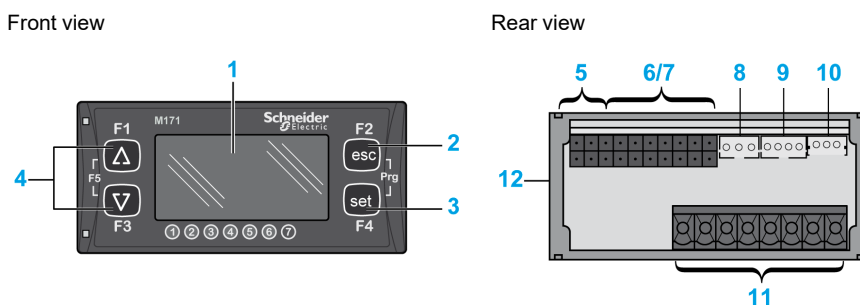
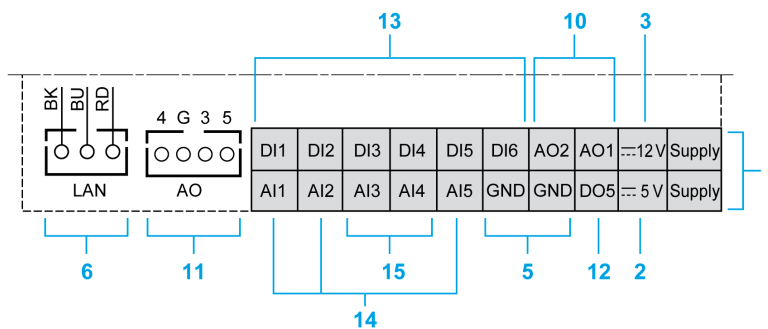| Number	
1…4	User interface, page 108
5	12…24 Vac or 24 Vdc power supply
6/7	Input/output connector
8	LAN expansion bus port
9	Analog output connector
10	RS-485 serial port [1]
11	Digital output connector
12	TTL programming port located on side of the device
(1)	Only for TM171O•M•••.

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Rear view:

Num-ber	Description	
1	12…24 Vac or 24 Vdc power supply, page 69	
2	5 Vdc auxiliary supply, 20 mA maximum	
3	12 Vdc auxiliary supply, 70 mA maximum	
4	N: Common for digital output	
5	GND: Ground	
6	LAN expansion bus port, page 82	
7	RS-485 serial port, page 84 (1)	
8	TTL programming port, page 86	
9	DO1…DO4, DO6	High voltage relay digital output, page 75
10	AO1, AO2	Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80
11	AO3…AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
12	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
13	DI1…DI6	Dry contact digital input, page 73
14	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
15	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73
(1)		Only for TM171O•M•••.

> # *NOTICE*
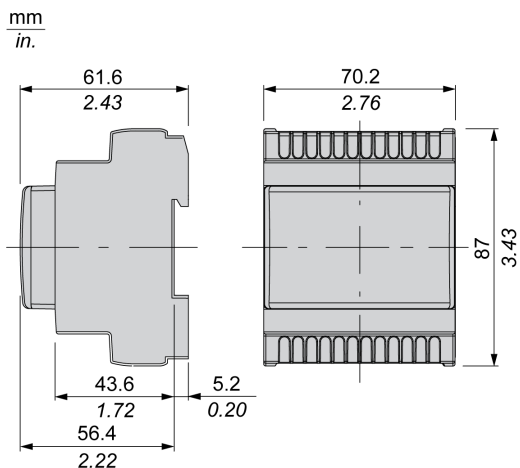>
> **INOPERABLE EQUIPMENT**
>
> Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.
>
> **Failure to follow these instructions can result in equipment damage.**

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

Dimension

TM171EO15R

Physical Description

The following illustration presents a TM171EO15R expansion module:

Number	Description
1	12…24 Vac or 24 Vdc power supply
2	Input/output connector
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	Analog output connector
5	LAN expansion bus port
6	TTL programming port
7	Digital output connector

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Top view:

Bottom view:

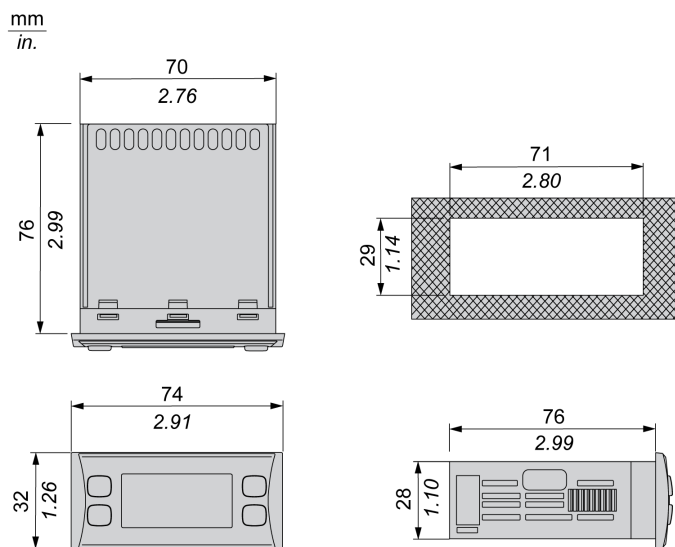| Num-ber	Description	
1	12…24 Vac or 24 Vdc power supply, page 69	
2	12 Vdc auxiliary supply, 70 mA maximum	
3	N: Common for digital output	
4	GND: Ground	
5	LAN expansion bus port, page 82	
6	TTL programming port, page 86	
7	DO1…DO3	High voltage relay digital outputs, page 75
8	AO1, AO2	Low voltage (SELV) analog outputs: Open Collector PPM, page 80
9	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
10	DI1…DI6	Dry contact digital input, page 73
11	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73

NOTICE

INOPERABLE EQUIPMENT

Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

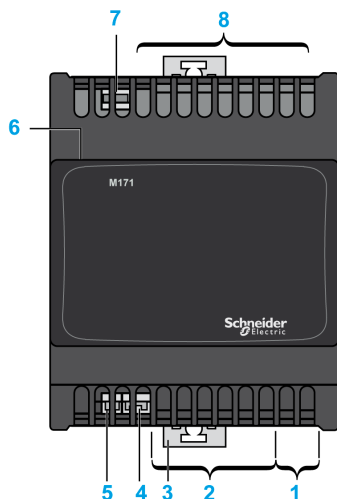# Dimension

TM171EO22R

Physical Description

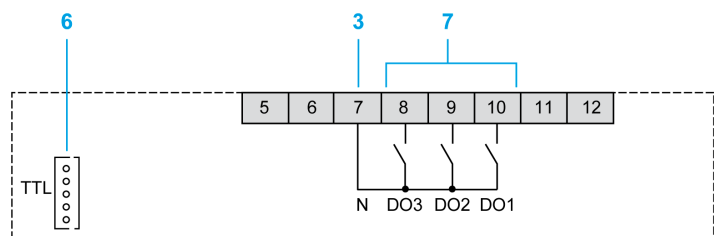The following illustration presents a TM171EO22R expansion module:
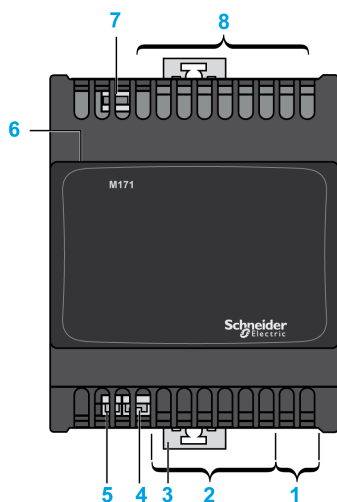
Number	Description
1	12…24 Vac or 24 Vdc power supply
2	Input/output connector

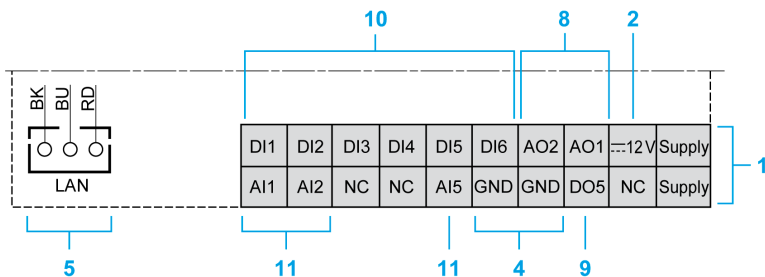| Number	Description
3	Clip-on lock for 35-mm (1.38 in.) Top hat section rail (DIN rail). For more details, refer to Installation, page 37.
4	Analog output connector
5	LAN expansion bus port
6	TTL programming port
7	Digital output connector

NOTE: Removable terminal blocks and wired connector to be ordered separately. Refer to accessories, page 21.

Connectors Description

Top view:

Bottom view:

Number	Description	
1	12…24 Vac or 24 Vdc power supply, page 69	
2	5 Vdc auxiliary supply, 20 mA maximum	
3	12 Vdc auxiliary supply, 70 mA maximum	
4	N: Common for digital output	
5	GND: Ground	
6	LAN expansion bus port, page 82	
7	TTL programming port, page 86	
8	DO1…DO4, DO6	High voltage relay digital outputs, page 75
9	AO1, AO2	Low voltage (SELV) analog outputs: Open Collector PPM, page 80
10	AO3…AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80
11	DO5	Low voltage (SELV) digital outputs: Open Collector, page 74
12	DI1…DI6	Dry contact digital input, page 73

Num-ber	Description	
13	AI1, AI2, AI5	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
14	AI3, AI4	Configurable as: • NTC analog input, page 76 • 0…20 mA or 4…20 mA current analog input, page 78 • 0…1 Vdc, 0…5 Vdc, or 0…10 Vdc voltage analog input, page 79 • Dry contact digital input, page 73

NOTICE

INOPERABLE EQUIPMENT

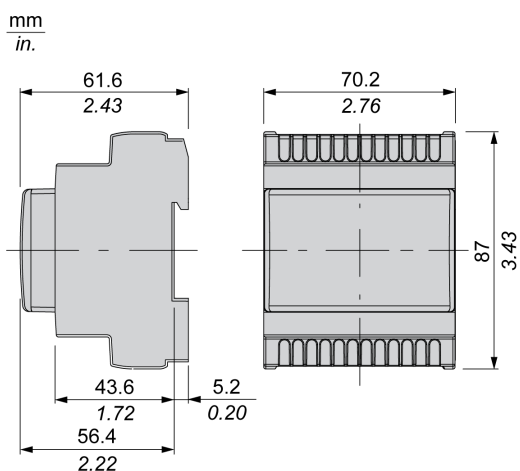Configure the analog inputs and outputs, and related parameters, according to the physical types of resources connected.

Failure to follow these instructions can result in equipment damage.

For more details, refer to analog inputs configuration, page 125 and analog outputs configuration, page 127.

For more information about the wiring, refer to wiring best practices, page 29.

Dimension

Electrical Characteristics and Wiring Diagrams

What's in This Chapter

Connectors

Connectors

TM171•••14R Connectors Characteristics

The TM171•••14R devices are delivered with removable terminal blocks:
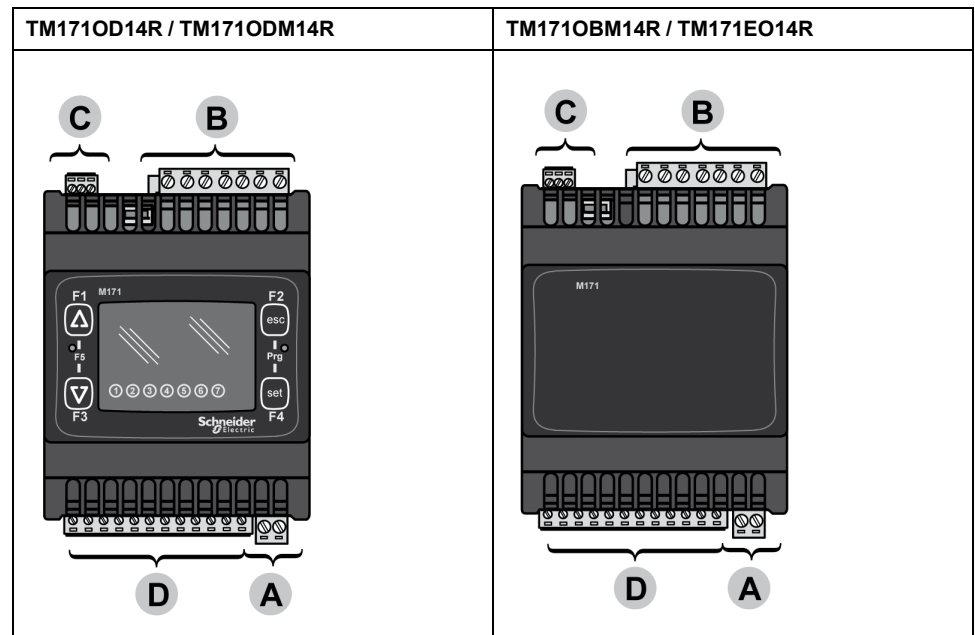
TM171OD14R / TM171ODM14R	TM171OBM14R / TM171EO14R

Connectors, terminal blocks, and cables description:

Type	Item	Connector Description	To be used with
High voltage	A	2-way high voltage connector	Supplied female terminal block
	B	7-way high voltage connector	Pitch 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.), page 30
Low voltage	D	12-way low voltage connector	Supplied female terminal block
Serial - RS-485[1]	C	3-way low voltage connector	Pitch 3.81 mm (0.15 in.) , page 30
Serial - LAN	-	3-way LAN connector	TM171ACB4OLAN, page 21 (provided with remote display and expansion module)

Type	Item	Connector Description	To be used with
Serial - TTL	-	5-way connector	TM171AMFK / TM171ADMI, page 21

| (1) | | Only for TM171O•M••• | |

For more information about the wiring, refer to wiring best practices, page 29.

TM171•••22• / TM171EO15R Connectors Characteristics

TM171•••22• / TM171EO15R are not delivered with terminal blocks and wired cables. They have to be ordered separately.
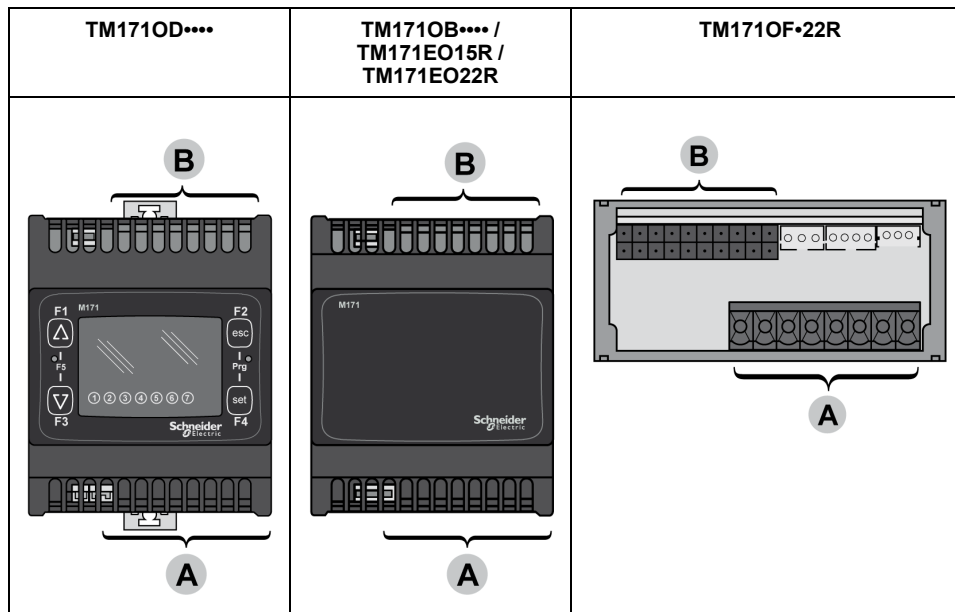
TM171OD••••	TM171OB•••• / TM171EO15R / TM171EO22R	TM171OF•22R

Connectors, terminal blocks, and cables description:

Type	Item	Connector Description	To be used with
High voltage	B	8-way high voltage connector	TM171ACB4OI1M / TM171ACB4OI2M, page 21
Low voltage	A	20-way low voltage connector	
	-	4-way connector	TM171ACB4OAO1M / TM171ACB4OAO2M, page 21
Serial - RS-485[1]	-	3-way low voltage connector	TM171ACB4ORS485, page 21
Serial - LAN	-	3-way LAN connector	TM171ACB4OLAN, page 21
Serial - TTL	-	5-way connector	TM171AMFK / TM171ADMI, page 21

| (1) | | Only for TM171O•M••• | |

NOTE: The screw terminal block of the TM171ACB4OI1M / TM171ACB4OI2M is a Pitch 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.), page 30.

For more information about the wiring, refer to wiring best practices, page 29.

Cabling Length

Cabling Length

Power Supply, I/O, and Serial Lines Maximum Length

Peripheral type	Maximum Length
Power supply	10 m (32.808 ft)
Embedded sensor PS	
Digital inputs	
Analog inputs	
Configurable analog outputs	
FAN analog output	
Supply for remote display	
Modbus SL Bus	1000 m (3280.83 ft)
LAN expansion bus	100 m (328 ft).
TTL programming port	30 cm (11.8 in)

Power Supply

Power Supply

TM171••14R

The TM171O••14R / TM171EO14R require a nominal voltage of 100…240 Vac isolated (50/60 Hz).

Power supply wiring diagram:

100…240 Vac		
(1)		Type T fuse 160 mA

⚠ DANGER

GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT

- Do not connect the 0 V power supply/transformer connection supplying this equipment to any external ground (earth) connection.
- Do not connect any 0 V or ground (earth) of the sensors and actuators connected to this equipment to any external ground connection.
- If necessary, use separate power supplies/transformers to power sensors or actuators isolated from this equipment.

Failure to follow these instructions will result in death or serious injury.

In all cases, if the specified voltage range is not maintained, the products may not function as intended. Use appropriate safety interlocks and voltage monitoring circuits.

TM171•••22• / TM171EO15R

References	Power Supply
TM171•••22R	12…24 Vac (+/- 10 %) not isolated - 50/60 Hz
TM171EO15R	24 Vdc (+/- 10 %) not isolated
TM171ODM22S	12…24 Vac (+/- 10 %) not isolated - 50/60 Hz

Power supply wiring diagram:

12/24 Vac	24 Vdc

(1)	Type T fuse (Controller: 1.25 A, Expansion: 1 A)
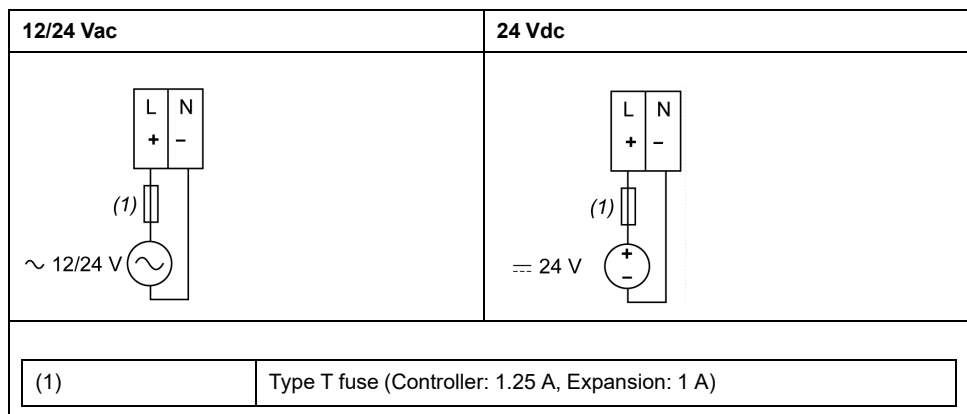
The power supplies for the TM171•••22•/TM171EO15R must be rated Safety Extra Low Voltage (SELV) according to IEC 61140. These sources of power are isolated between the electrical input and output circuits of the power supply as well as simple separation from ground (earth), PELV, and other SELV systems.

⚠ DANGER

GROUND LOOP CAUSING ELECTRIC SHOCK AND/OR INOPERABLE EQUIPMENT

- Do not connect the 0 V power supply/transformer connection supplying this equipment to any external ground (earth) connection.
- Do not connect any 0 V or ground (earth) of the sensors and actuators connected to this equipment to any external ground connection.
- If necessary, use separate power supplies/transformers to power sensors or actuators isolated from this equipment.

Failure to follow these instructions will result in death or serious injury.

In all cases, if the specified voltage range is not maintained, the products may not function as intended. Use appropriate safety interlocks and voltage monitoring circuits.

⚠ **WARNING**
POTENTIAL OF OVERHEATING AND FIRE
• Do not connect the equipment directly to line voltage.
• Use only isolating SELV, Class 2 power supplies / transformers to supply power to this equipment.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Inputs and Outputs

Inputs and Outputs

Overview

This section presents the I/O of controllers and expansion modules.

For details on types and number of inputs and outputs for each device, refer to:

- Device Description TM171O••14R, page 44
- Device Description TM171O••22•, page 52

Numbers of Inputs and Outputs

This table presents the I/O of controllers and expansion modules:

Type	Label	Description	Controllers			Expansion modules		
			TM171O••14R	TM171ODM22S	TM171O••22R	TM171EO14R	TM171EO15R	TM171EO22R
Digital inputs	DI1, DI2	Dry contact digital input, page 73 **NOTE:** For TM171O•••••, inputs are also configurable as analog outputs (PWM/PPM) **NOTE:** For TM171EO••••, inputs are also configurable as analog outputs (PPM)			✓			
	DI3…DI6	Dry contact digital input, page 73	-	✓	✓	-	✓	✓
Digital outputs	DO1…DO3	High voltage relay digital output, page 75			✓			
	DO4	High voltage relay digital output, page 75	-	-	✓	-	-	✓
		Open Collector outputs, page 74	-	✓	-	-	-	-
	DO5	Open Collector outputs, page 74 (2)	-	✓	✓	-	✓	✓
	DO6	High voltage relay digital output, page 75	✓	-	✓	✓	-	✓
TRIAC Output	TC1	TRIAC output, page 76						
	TC2/AO2 (1)	Remote control switches downstream from the TRIAC are NOT permitted.	-	✓	-	-	-	-

Type	Label	Description	Controllers			Expansion modules		
			TM171O••14R	TM171ODM22S	TM171O••22R	TM171EO14R	TM171EO15R	TM171EO22R
Analog inputs	AI1…AI5	Configurable analog inputs. Refer to: • TM171O••14R / TM171EO14R Analog Inputs, page 72 • TM171O••22• / TM171EO15R Analog Inputs, page 73						
Analog outputs	AO1, AO2	For TM171O••••• controllers: Low voltage (SELV) analog outputs: Open Collector PWM/PPM, page 80 For TM171EO•••• expansion modules: Low voltage (SELV) analog outputs: Open Collector PPM, page 80	✓	✓(1)	✓	✓	✓	✓
	AO3, AO4 (3)	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80	✓	✓	✓	✓	-	✓
	AO5	Low voltage (SELV) analog outputs: • 0…10 Vdc, page 80	-	✓	✓	-	-	✓
	AO5(3)	Current analog outputs configurable as: • 0…20 mA, page 81 • 4…20 mA, page 81	✓	-	-	✓	-	-

(1)	TC2 is configured by the AO2 parameters. Refer to Configuration physical I/O, page 123.
(2)	Outputs AO1, AO2, and DO5 (typically connected to the 12 Vdc auxiliary supply of the device) cannot deliver more than 70 mA in total. Any other loads connected to the same 12 Vdc auxiliary supply must also be taken into account. If the TM171DLED remote display is connected to the device, the current is limited to 55 mA.
(3)	Outputs AO3, AO4, and AO5 cannot deliver more than 40 mA in total.

TM171O••14R / TM171EO14R Analog Inputs

Configurable analog inputs compatibility and characteristics:

	NTC, page 76	Current, page 78	Voltage, page 79	Dry contact digital input, page 73	Pt1000, page 77 (2)
	10 kΩ at 25 °C(1) Beta 3435	0…20 mA 4…20 mA	0…10 V 0…5 V 0…1 V		
AI1		-	-		✓
AI2		-	-		✓
AI3	✓	✓	✓	✓	-
AI4		✓	✓		-
AI5		-	-		✓

(1)	Dedicated AFB allow you to use other type of NTC.
(2)	Only for TM171O••14R.

TM171O••22• / TM171EO15R Analog Inputs

Configurable analog inputs compatibility and characteristics:

	NTC, page 76	Current, page 78	Voltage, page 79	Dry contact digital input, page 73
	10 kΩ at 25 °C[1] Beta 3435	0…20 mA 4…20 mA	0…10 V 0…5 V 0…1 V	
AI1		-	-	
AI2		-	-	
AI3	✓	✓	✓	✓
AI4		✓	✓	
AI5		-	-	

(1)	Dedicated AFB allow you to use other type of NTC.

Digital Input

Dry Contact Digital Inputs

Characteristics

The table indicates the dry contact digital inputs characteristics:

Characteristic	Value
Type	Dry contact digital input Closing current for ground: 0.5 mA
Logic type	Digital inputs work in negative logic
Level 1	Resistance < 500 Ω
Level 0	Resistance > 100 kΩ
ON to OFF detection time	< 200 ms (hardware delay)
OFF to ON detection time	< 200 ms (hardware delay)

The use of an external power supply with the dry contact digital inputs can result in equipment damage.

NOTICE

INOPERABLE EQUIPMENT

Do not apply external power supply to the dry contact digital inputs of the device.

Failure to follow these instructions can result in equipment damage.

Logic type description

Logic type	Active state
Positive logic	Output supplies current (source output)
	Current flows to the input (sink input)
Negative logic	Output draws current (sink output)
	Current flows from the input (source input)

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171O••22R digital inputs wiring example:

For more information about the wiring, refer to Best wiring practices, page 29.

Digital Output

Open Collector (OC) Output

Characteristics

The table indicates the Open Collector outputs characteristics:

Characteristic	Value
Voltage Range	0…12 Vdc
Maximum current	35 mA at 12 Vdc
Maximum load impedance	340 Ω at 12 Vdc

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OF•22R Low voltage (SELV) Open Collector output wiring diagram example:
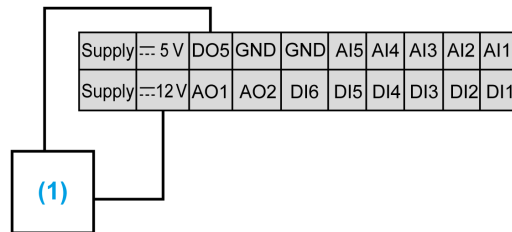
(1) External relay

For more information about the wiring, refer to wiring best practices, page 29.

Relay Output

Characteristics

The table indicates the digital outputs characteristics:

Characteristic	Value
Maximum voltage	240 Vac
Maximum current	2 A
Minimum switching capacity	100 mA
Electrical durability conforming to UL60730	30000 cycles, 2 A at 240 Vac

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OF•22R relay outputs wiring diagram example:

For more information about the wiring, refer to wiring best practices, page 29.

TRIAC Output

Characteristics

The table indicates the TRIAC output characteristics:

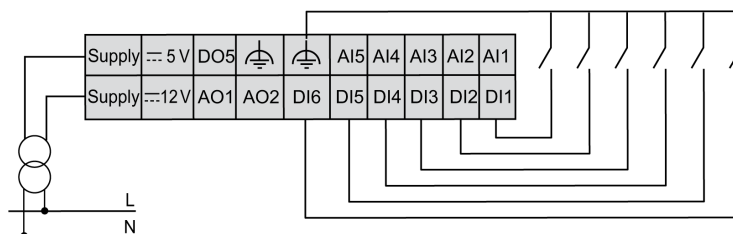| Characteristic	Value
Nominal voltage	240 Vac
Maximum current	2 A
Maximum switching rate	100 Hz

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171ODM22S TRIAC high voltage outputs wiring diagram example:

For more information about the wiring, refer to wiring best practices, page 29.

Analog Input

NTC

Characteristics

The table indicates the input characteristics for NTC temperature sensing (NTC at 10 kΩ at 25 °C / 77 °F):

Characteristic	Value
NTC type	10 kΩ at 25 °C (77 °F) (Beta 3435)
Input impedance	10 kΩ
Range	-50…+100 °C (-58…212 °F)
Accuracy	1% full-scale
Resolution	0.1 °C (32.18 °F)
Conversion time	200 ms
Value of Least Significant Bit (LSB)	0.07 °C (32 °F)
Isolation	None

Characteristic	Value
Built-in protection	None
Digital resolution	A/D conversion: 13 bits

NOTE: Dedicated AFB allow you to use other type of NTC.
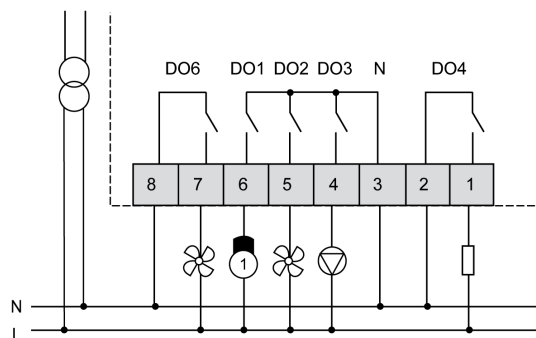
Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171O••14R / TM171EO14R NTC input connection wiring diagram example:

For more information about the wiring, refer to wiring best practices, page 29.

Pt1000

Characteristics

The table indicates the input characteristics for temperature sensing (Pt1000):

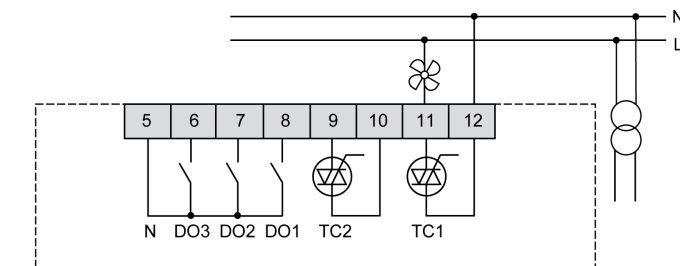| Characteristic	Value
Input impedance	2 kΩ
Range	-50…+400°C (-58…752°F)
Accuracy	1% full-scale
Resolution	0.1 °C (32.18 °F)
Conversion time	200 ms
Isolation	None
Built-in protection	None
Digital resolution	A/D conversion: 13 bits

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171O••14R Pt1000 input wiring diagram example:

If one Pt1000 is set, three AI1/AI2/AI5 are configured as Pt1000.

For more information about the wiring, refer to wiring best practices, page 29.

Current Analog Input

Characteristics

The table indicates the input characteristics for current sensing:

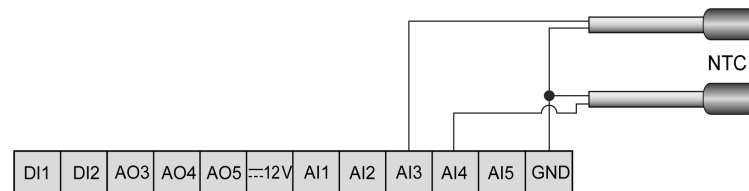| Characteristic	Value
Range	0…20 mA, 4…20 mA
Input impedance	100 Ω
Accuracy	1% full-scale
Resolution maximum	1 µA
Conversion time	200 ms
Isolation	None
Maximum current	25 mA
Built-in protection	None
Digital resolution	A/D conversion: 13 bits

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OF•22R current input connection wiring diagram example:
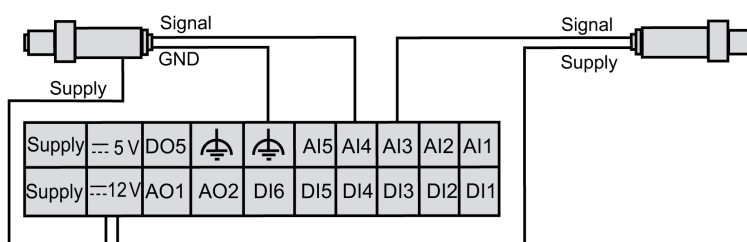
You can power the transducer from the M171O (5 Vdc or 12 Vdc) or with an external supply.

For more information, refer to transducer technical data sheet.

For more information about the wiring, refer to wiring best practices, page 29.

Voltage Analog Input

Characteristics

The table indicates the input characteristics for voltage sensing:

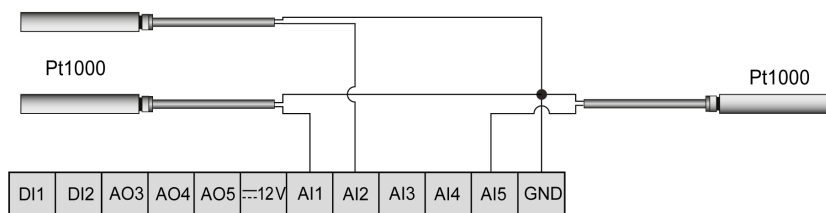| Characteristic	Value		
Range	0…1 Vdc	0…5 Vdc	0…10 Vdc
Input impedance	110 kΩ	110 kΩ	21 kΩ
Accuracy	2% full-scale	1% full-scale	
Resolution maximum	1 mV		
Maximum voltage	11 Vdc		
Conversion time	200 ms		
Isolation	None		
Built-in protection	Reverse protection		
Digital resolution	A/D conversion: 13 bits		

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OF•22R voltage input connection wiring diagram example:

TM171OF•22R 0-5V ratiometric voltage input connection wiring diagram example:
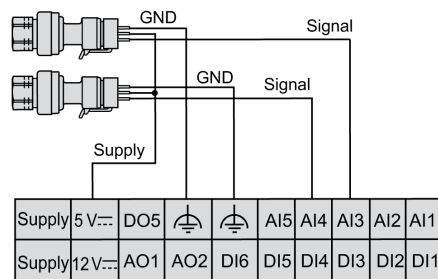
For more information about the wiring, refer to wiring best practices, page 29.

Analog Output

Open Collector PWM/PPM Outputs

Characteristics

The table indicates the Open Collector PWM/PPM outputs characteristics:

Characteristic	Value
Maximum load voltage	12 Vdc
Minimum load impedance	340 Ω at 12 Vdc
Accuracy	2 %
Resolution	1 %
Isolation	None
Built-in protection	Against overload (thermal protection)

NOTE:

For TM171O•••• controllers, PWM and PPM are available.

For TM171EO•••• expansion modules, only PPM is available.

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OF•22R open Collector PWM/PPM analog output (AO1) connection wiring diagram example:

| Supply | --- 5 V | DO5 | GND | GND | AI5 | AI4 | AI3 | AI2 | AI1 |
| Supply | ---12 V | AO1 | AO2 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 |

(1) Third-party actuator (for example: fan module) or external relay

For more information about the wiring, refer to wiring best practices, page 29.

Low Voltage (SELV) Analog Outputs

Characteristics

The table indicates the input characteristics for voltage sensing:

Characteristic	Value
Range	0…10 Vdc
Minimum load impedance	360 Ω at 10 Vdc

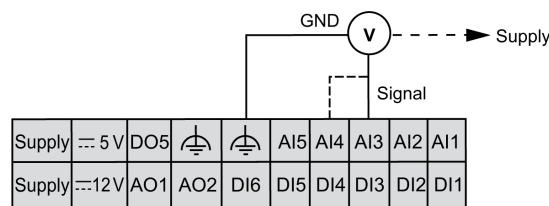| Characteristic	Value
Accuracy	2% full-scale
Step-wise resolution	1%
Conversion time	1 s
Isolation	None
Built-in protection	Against overload (thermal protection)

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171OD•22R low voltage (SELV) analog outputs (AO3, AO4, and AO5) connection wiring diagram example:
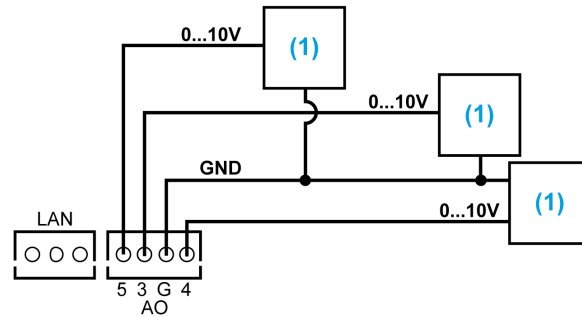
(1) Third-party actuator (for example: fan module)

For more information about the wiring, refer to wiring best practices, page 29.

Connector description:

Connector	Terminal no	Analog output	Description
4 G 3 5 ◯◯◯◯ AO	3	AO3	0…10 V
	G		GND
	4	AO4	0…10 V
	G		GND
	4	AO5	0…10 V
	G		GND

Analog Current Output

Characteristics

The table indicates the input characteristics for voltage sensing:

Characteristic	Value
Range	0…20 mA / 4…20 mA
Maximum Load impedance	350 Ω

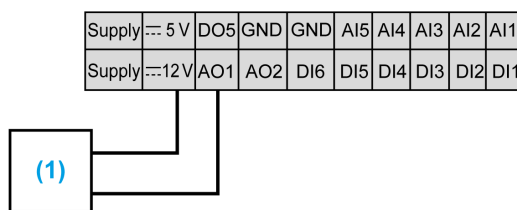| Characteristic	Value
Accuracy	2% full-scale
Step-wise resolution	1%
Conversion time	1 s
Isolation	None
Built-in protection	Against overload (thermal protection)

Observation

Verify the compatibility of this I/O with your product. Refer to chapter Inputs and Outputs, page 71.

The I/O must be configured. Refer to chapter Configuration Physical I/O, page 123.

Wiring Diagram

TM171O••14R low voltage (SELV) analog outputs (AO5) connection wiring diagram example:
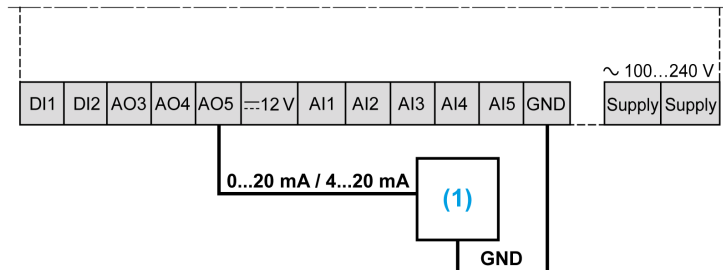
(1) Third-party actuator (for example: fan module)

For more information about the wiring, refer to wiring best practices, page 29.

LAN Expansion Bus Serial Port

LAN Expansion Bus Serial Port

Overview

The M171O devices can be connected through the LAN expansion bus.

You can connect:
- 1 controller (TM171O••14R or TM171O••22•)
- 1 expansion module (TM171EO••R) compatible with the controller
- 1 TM171DLED LED remote display
- 1 additional LCD remote display (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U)

Main Functions

The LAN expansion bus is composed by three wires.

The remote displays are powered by the LAN expansion bus.

The total LAN expansion bus length must not exceed 100 m (328 ft).

The LED remote display (TM171DLED) is compatible with all M171O controllers.

The LCD remote displays (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U) are compatible with the M171O controllers but only one additional LCD remote display can be connected to a controller.

Connector

LAN connector:

BK: Black = GND

BU: Blue = SIGNAL

RD: Red = 12 Vdc

Cables

To connect devices on a LAN expansion bus, use the following cable:

Reference	Description
TM171ACB4OLAN	LAN expansion bus cordset equipped with a 3-pin connector at each end 2 m (6.56 ft)

The TM171ACB4OLAN cable is delivered with the expansion modules and the remote displays.

To connect 2 devices together, use the LAN cable delivered with remote display or expansion module or order it separately (TM171ACB4OLAN).

To connect more devices, you should use the suitable cables and connector devices.

For LAN expansion bus length > 2 m (6.56 ft), a twisted pair shielded cable must be used.

The total LAN expansion bus length must not exceed 100 m (328 ft).

Wiring Example

LAN wiring diagram to connect a controller to an expansion module:
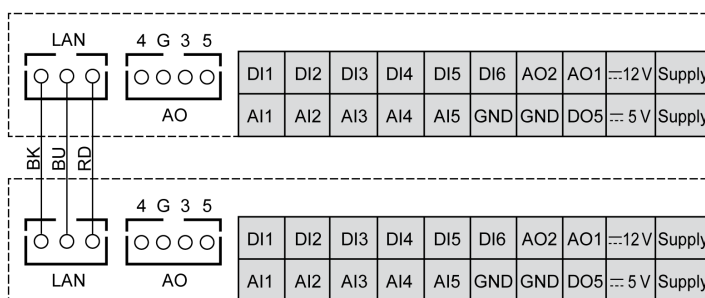
BK: Black = GND

BU: Blue = SIGNAL

RD: Red = 12 Vdc

For a wiring example, refer to Maximum Architecture Example, page 24.

Serial Port RS-485

Serial Port

Overview

Each TM171O•M••• controller is equipped by an RS-485 serial port.

This port permits user to communicate between the device and a Modbus device via a Modbus SL connection.

For more details, refer to Modbus RTU description, page 147.

> **NOTE:** The controller works as Modbus master or slave. The firmware that is delivered with the controller, msk542, allows you to select either a master or slave configuration. However, there is another version of the firmware, msk412, which is available with the SoMachine HVAC software that allows only a slave to be configured. The advantage to the slave-only firmware is that it frees up additional memory for your application.

> When the controller is configured as master, after power-on, the controller works as slave during 5 seconds.

Connector of TM171O••22• Controllers

The TM171O••22• controllers are equipped with an isolated RS-485 connector:
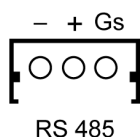
Gs: RS-485 signal reference

+: Signal D0

-: Signal D1

> **NOTE:** The Gs of the RS-485 is isolated from the GND of the device.

Connector of TM171O••14R Controllers

The TM171O••14R controllers are equipped with an RS-485 screw terminal block:
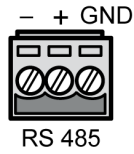
GND: RS-485 signal reference

+: Signal D0

-: Signal D1

> **NOTE:** GND of the RS-485 is connected to the GND of the device.

Cables

To communicate with the device by an RS-485 Modbus SL connection, use the following cable:

Reference	Description
TM171AC-B4ORS485	Modbus SL Cordset equipped with a 3-pin connector on one end 1 m (3.3 ft)

Wiring Example

The following diagram shows the RS-485 wiring, including line terminations:
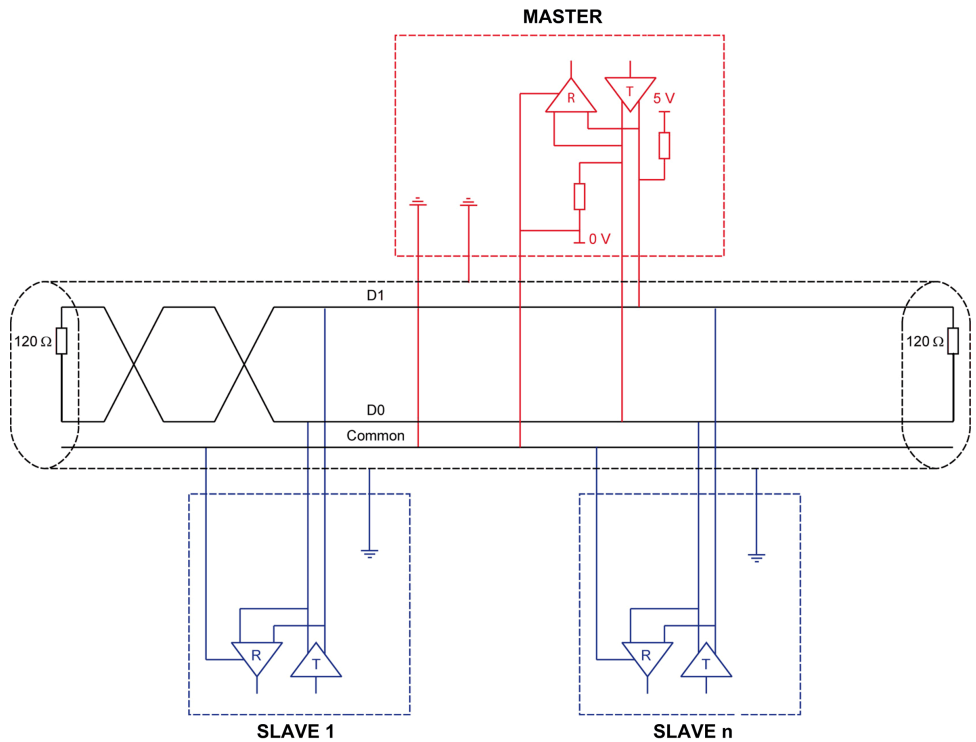
Characteristic	Definition
Type of trunk cable	Shielded cable with one twisted pair and at least a third conductor
Maximum length of bus	1000 m (3280 ft) at 19200 bps with a shielded and twisted cable (for example: TSXCSA•••)

Characteristic	Definition
Maximum number of devices (without repeater)	32 devices that are 31 slaves
Line terminator	One 120 Ω 0.25 W resistor

Wiring Restriction

For the TM171O•M••• controllers, the TTL and RS-485 serials cannot be used at the same time:
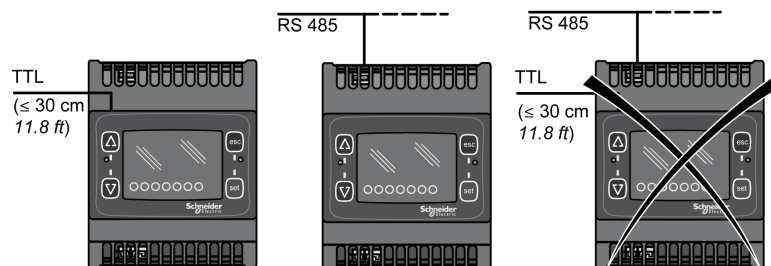
TTL Programming Port

TTL Programming Port

Overview

Each M171O controller and expansion module is equipped by a TTL programming port.

Description

The TTL programming port permits user to connect the device to:

- PC equipped with SoMachine HVAC to download BIOS, parameters, and applications.
- TM171AMFK programming stick to upload/download Parameters and to download BIOS and IEC applications

For more details, refer to accessories description, page 21.

Wiring Example

Refer to Data transfer description, page 144.

Wiring Restriction

For the TM171O•M••• controllers, the TTL and RS-485 serials cannot be used at the same time:
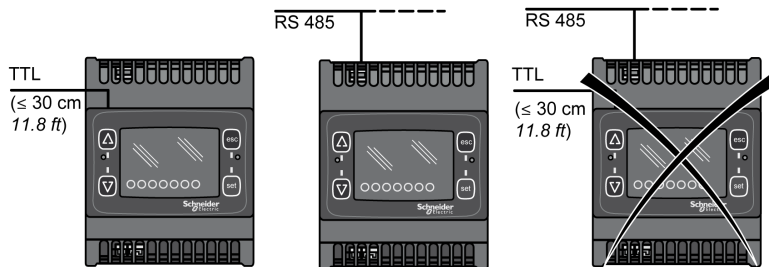
Memory

Memory

Memory Characteristics

The table indicates the characteristics of the memory:

Characteristic	Value
Flash program memory	185 kilo bytes
RAM data storage memory	2 kilo bytes

RTC (Real Time Clock)

RTC (Real Time Clock)

RTC Description

The table indicates the functions of the RTC:

Function	Description
Backup type	Super capacitor
RTC data retention time in the event of a power outage	3 days
Drift value	≤ 30 s/month at 25 °C (77 °F)

Remote Display

What's in This Part

Environmental Characteristics

What's in This Chapter

Environmental Characteristics

Environmental Characteristics

Characteristics	Specification	Remote display			
		TM171DLED	TM171DLCD2U	TM171DWAL2U	TM171DWAL2L
The product complies with the following harmonized regulations	EN 60730-2-6 / EN 60730-2-9	✓			
Product certifications	CE, CSA, cURus, EAC, RCM, RoHS China	✓			
IP degree of protection	IP20	✓	-		
	IP40 on front	-	✓		
	IP20 on back				
Intended Use	Electric automatic control (not safety) for incorporation	✓			
Purpose of Device	Remote display for M171O controller	✓			
Mounting	Panel	✓	✓	-	-
	Wall	-	-	✓	✓
	Wall with backplate accessory	-	✓	-	-
Type of action	1.B	✓			
Pollution class	2 (normal)	✓			
Insulation material group	IIIa	✓			
Over-voltage category	II	✓			
Nominal pulse voltage	2500 V	✓			
Digital outputs	Refer to the label on the device	✓			
Period of electric stress on the insulating parts	Long period	✓			
Ambient operating temperature	-20…55 °C (-4…131 °F)	✓			
Ambient operating humidity (non-condensing)	10…90 %	✓			
Ambient storage temperature	-40…85 °C (-40…185 °F)	✓			
Ambient storage humidity (non-condensing)	10…90 %	✓			
Power supply	12 Vdc (from controller through LAN Expansion bus)	✓			
Power consumption	0.5 W max	✓	-	-	-
	1 W max	-	✓	✓	-
	2 W max	-	-	-	✓
Insulation class	II	✓			
Fire-resistance category	D	✓			
Software class	A	✓			
Type of disconnection for each circuit	Micro disconnection	✓			

Installation

What's in This Chapter

TM171DLED Installation

Overview

This section shows how to install TM171DLED remote display using the special brackets provided. This section also provides mounting hole layout.

Correct Mounting Position

The TM171DLED remote display must be mounted horizontally on a vertical panel.

Mounting Hole Layout

The following diagram shows the mounting hole layout for TM171DLED remote display:
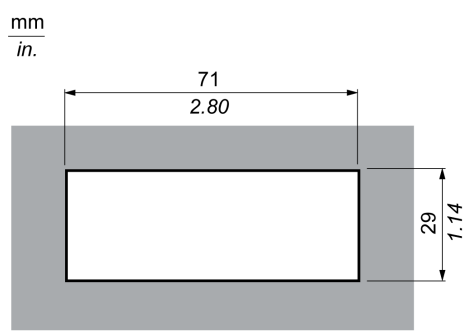
Installing TM171DLED on Panel

The following procedure shows how to install TM171DLED remote display:

Step	Action
1	Make a 29x71 mm (1.14 x 2. 80 in) hole using the mounting hole layout.
2	Insert the device.
3	Secure it with the special brackets provided:

TM171DLCD2U Installation

Overview

This section shows how to install TM171DLCD2U remote display on a wall or on a panel using the wall mounting accessories. This section also provides mounting hole layout.

Correct Mounting Position

The TM171DLCD2U remote display must be mounted horizontally on a vertical panel (landscape).

Panel Mounting Hole Layout
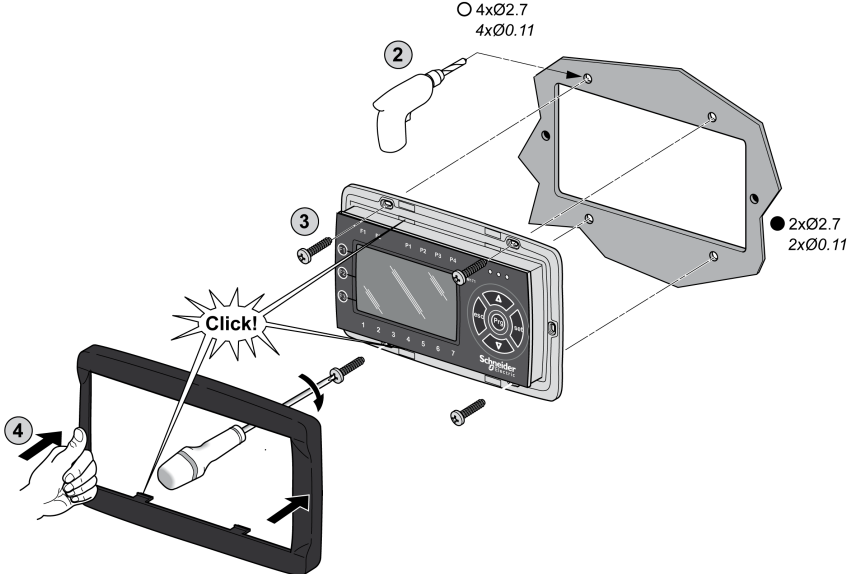
The following diagram shows the mounting hole layout for TM171DLCD2U remote display:
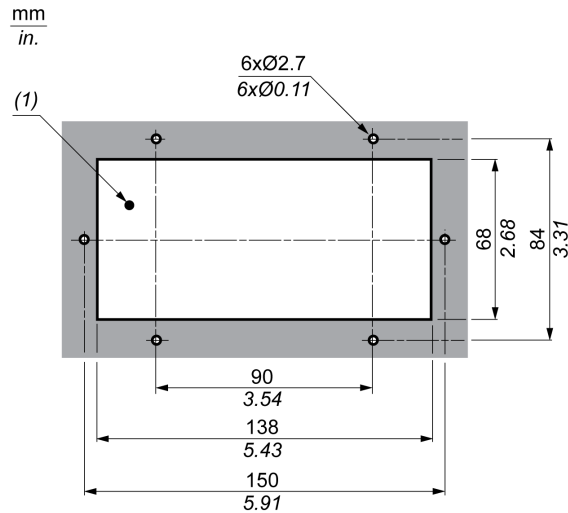
(1) Panel cut out

Installing TM171DLCD2U on a Panel

The following procedure shows how to install TM171DLCD2U remote display:

Step	Action
1	Remove the front panel.
2	Make a 138x68 mm (5.43x2.68 in) hole using the mounting hole layout.
	Drill 4 holes of diameter 2.7 mm (0.11 in) in the panel at the specified spacing as indicated in the TM171DLCD2U mounting hole layout.
3	Insert the device and fix it with the M3x10 screws.
4	Close the front panel of the device by pressing it.

Installing TM171DLCD2U on a Wall

The TM171DLCD2U can be wall mounted by using TM171ABKP• backplate.
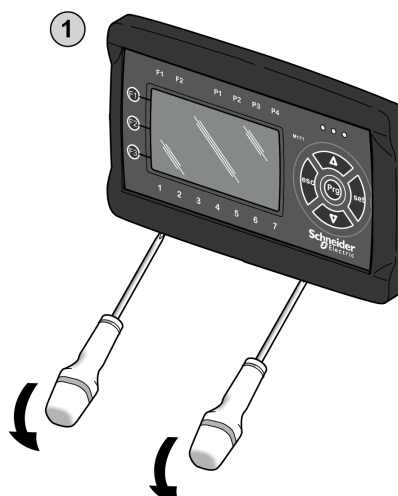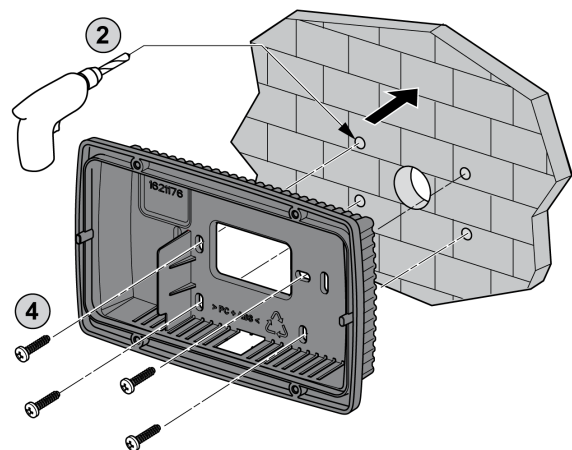
Code	Description
TM171ABKPB	White backplate kit for wall mounting
TM171ABKPG	Black backplate kit for wall mounting
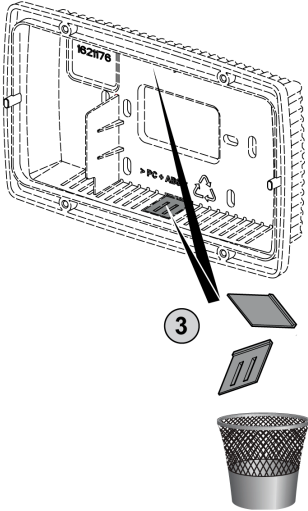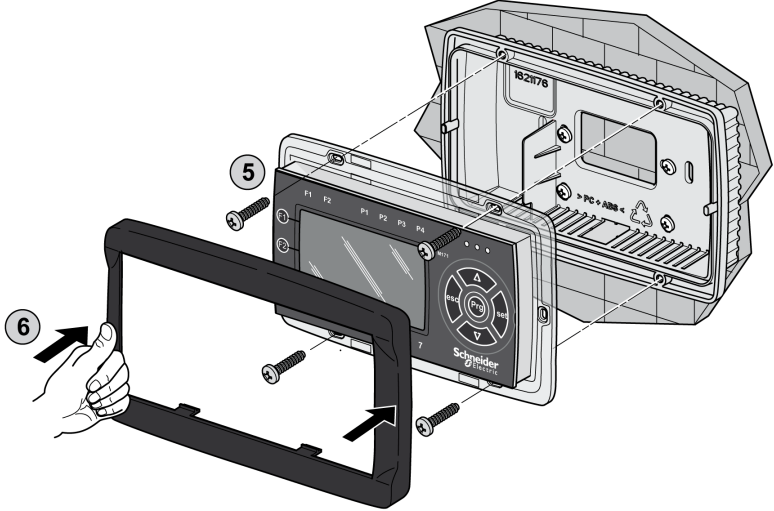
Wall Mounting Hole Layout

TM171DLCD2U wall mounting dimensions:

$\dfrac{mm}{in.}$

4xØ4.2
6xØ0.17

28.5
1.12

59
2.32
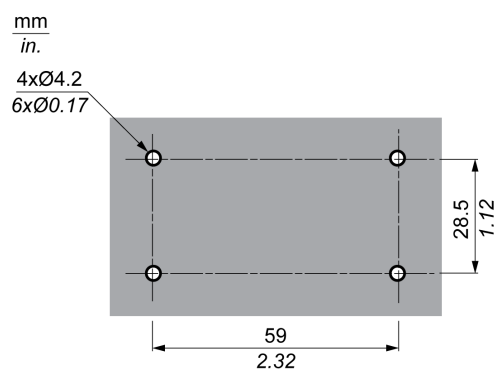
TM171DLCD2U installation procedure:

Step	Action
1	Remove the front panel.
2	Drill 4 holes in the wall at the specified spacing as indicated in the TM171DLCD2U wall mounting dimensions drawing.
3	To prevent the holes in walls, you can also use the two side slots (one at the bottom and one at the top) under the corresponding break-open removable doors.

Step	Action
4	Insert the backplate on the wall and fix it with 4 screws.
5	Make all the necessary connections.
6	Insert the TM171DLCD2U (without front) onto the backplate and fix it with the 4 screws.
7	Close the front panel of the device by pressing it with your fingers.

TM171DWAL2U / TM171DWAL2L Installation

Overview

This section shows how to install TM171DWAL2U / TM171DWAL2L remote display. This section also provides mounting hole layout.

Correct Mounting Position

The TM171DWAL2U / TM171DWAL2L remote display must be mounted horizontally on a vertical wall (landscape).

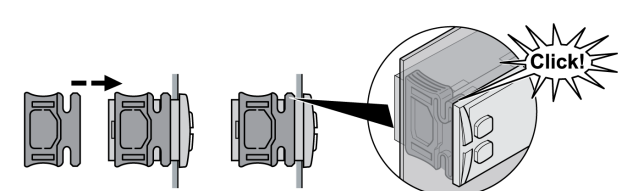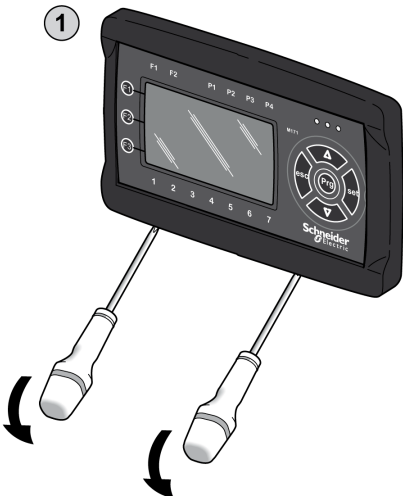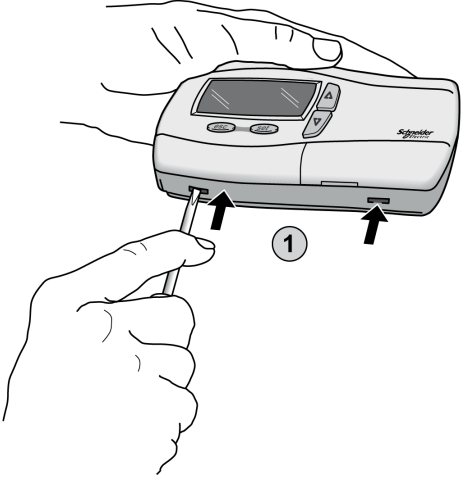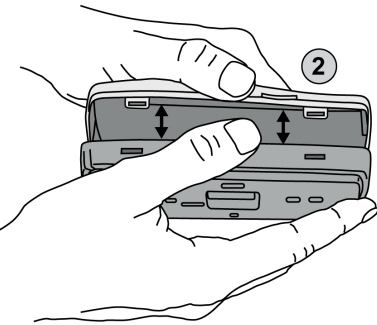# Mounting Hole Layout
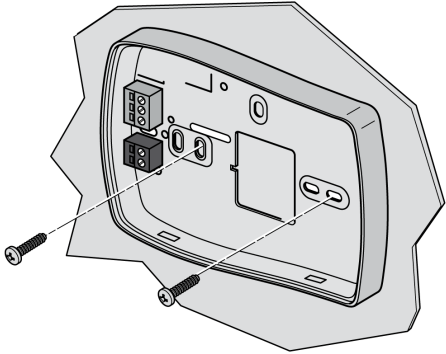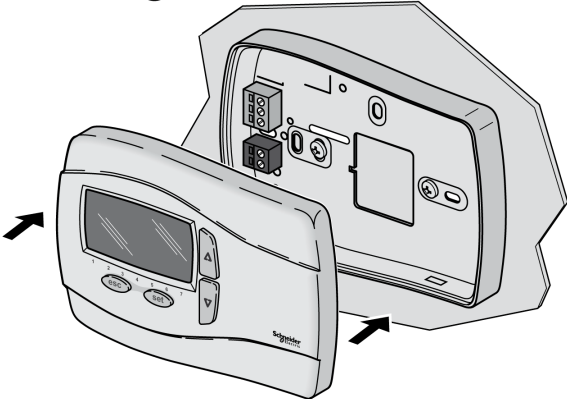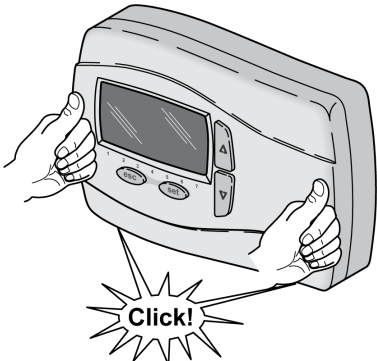
The following diagram shows the mounting hole layout for TM171DWAL2• remote display:
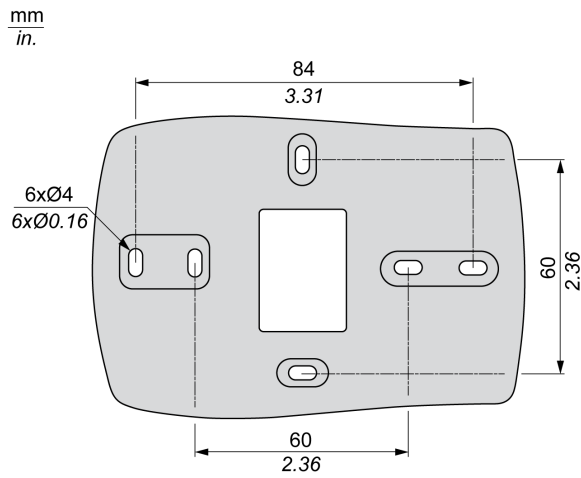
Installing TM171DWAL2U / TM171DWAL2L on a Wall

The following procedure shows how to install TM171DWAL2• remote display:

Step	Action
1	Open the front panel of the appliance with a screwdriver or similar tool:
2	Remove the front panel:
3	Drill 2 holes of diameter 4 mm (0.16 in) in the wall at the specified spacing as indicated in the TM171DWAL2• wall mounting dimensions drawing, page 95.

Step	Action
	Position the back of the device on the wall and fix it with 2 screws.
4	Make all the necessary connections.
5	Close the front panel of the remote display by pressing it.

Device Description

What's in This Chapter

TM171DLED

Physical Description

The following illustrations present a TM171DLED remote display:

Front view   Rear view
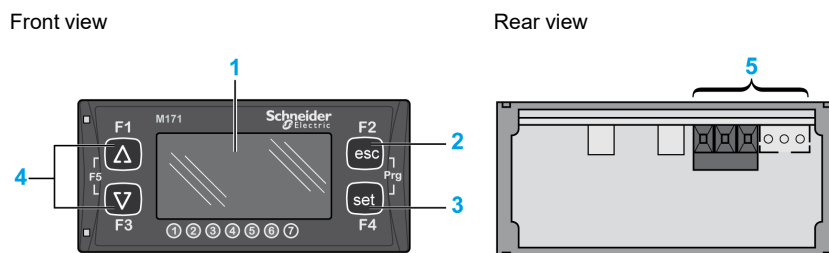
Number	Description	
1	Display area	User interface, page 108
2	**Esc** key	
3	**Set** key	
4	**UP** and **DOWN** keys	
5	LAN expansion bus	

Connectors

Rear view:

BK: Black = GND

BU: Blue = SIGNAL

RD: Red = 12 Vdc

Num-ber	Description	Details
1	1 screw terminal block for LAN Expansion bus, page 105.	The power supply of the remote display is provided by the controller via the LAN expansion bus cable.
2	1 connector for LAN Expansion bus, page 105. To be used with TM171ACB4OLAN cable delivered with the remote display.	

NOTE: The terminal block and the connector are in parallel. You can, for example, connect the controller to the terminal block and connect the expansion module to the connector.

Dimension
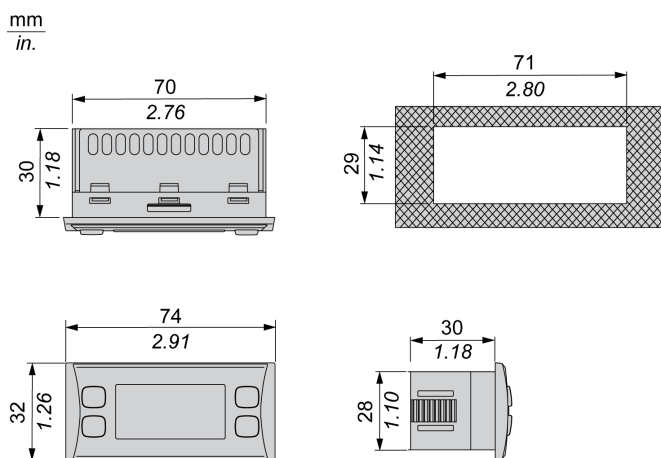
TM171DLCD2U

Physical Description

The following illustrations present a TM171DLCD2U remote display:

Front view

Rear view
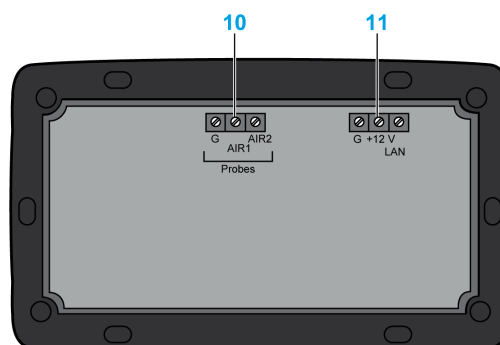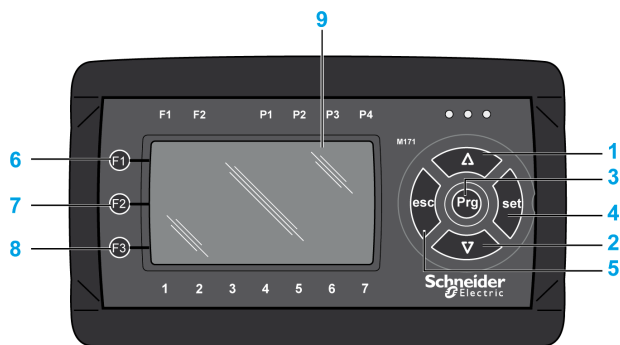
Number	Description	
1	**UP** key	User interface, page 108
2	**DOWN** key	
3	**Prg** key: equivalent to **Esc+Set** keys	
4	**Set** key	
5	**Esc** key	
6	**F1** key: equivalent to long press **UP** key	
7	**F2** key: equivalent to long press **Esc** key	
8	**F3** key: equivalent to long press **DOWN** key	
9	LCD graphic without backlight	

Number	Description
10	Configurable analog inputs port
11	LAN expansion bus port

NOTE: There is no LED on the front face of this device.

Connectors Description

Rear view:

Num- ber	Description	
1	G: Common for analog input	
	AIR1	Configurable as: • NTC analog input, page 76 • Dry contact digital input, page 73
	AIR2	Configurable as: • NTC analog input, page 76 • Low voltage (SELV) analog current input: 4…20 mA, page 78 • Dry contact digital input, page 73
2	LAN Expansion bus, page 105 screw terminal block The power supply of the device is provided by the controller via the LAN expansion bus.	

Input Wiring Diagram Examples

NTC and digital Input wiring diagram example:

Transducer wiring diagram example:

NTC
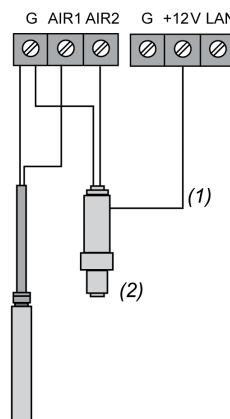
(1) The LAN connector can provide the power supply of the transducer

(2) Transducer

NOTE: Each connected display has to be accounted for in the power budget of 70 mA available.

Refer to the consumption characteristics, page 89 for the various types of displays and take that into account when powering external devices with the power supply.

Dimension
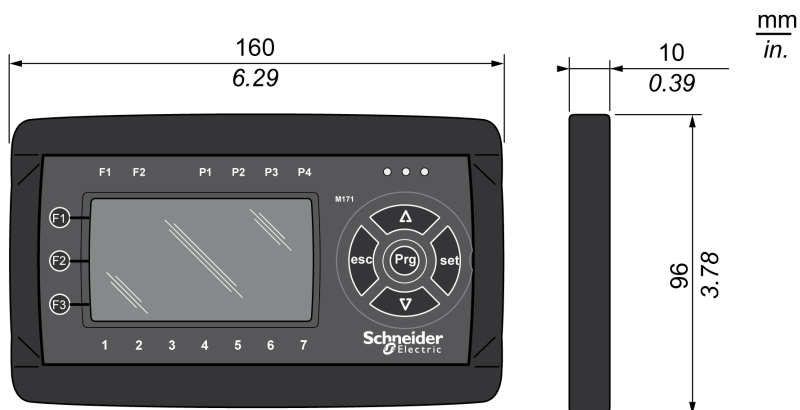
TM171DWAL2U / TM171DWAL2L

Physical Description

The following illustrations present the TM171DWAL2U / TM171DWAL2L remote display:

Front view
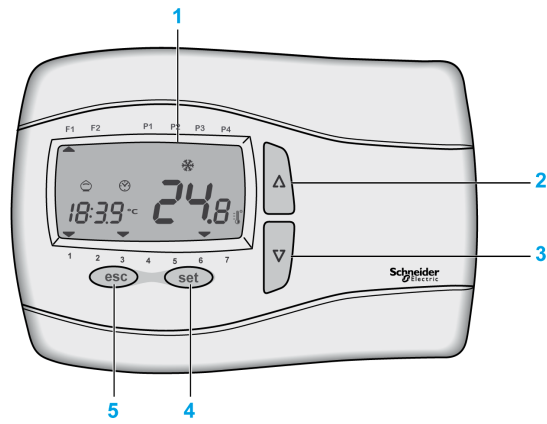
Number	Description	
1	LCD graphic display	User interface, page 108
2	**UP** key	
3	**DOWN** key	
4	**Set** key	
5	**Esc** key	
-	2 x LAN expansion bus port	

Connectors Description

The following illustrations present a TM171DWAL2• remote display:

View of the back part

Rear view of the front part

BK: Black = GND

BU: Blue = SIGNAL

RD: Red = 12 Vdc

Num-ber	Description		Details
1	1 screw terminal block for LAN Expansion bus, page 105.		The power supply of the remote display is provided by the controller via the LAN expansion bus cable.
4	1 connector for LAN Expansion bus, page 105. To be used with TM171ACB4OLAN cable delivered with the remote display.		
2	AIR2	Configurable as: • NTC analog input, page 76 • Low voltage (SELV) analog current input: 4…20 mA, page 78 • Dry contact digital input, page 73	
3	Cable access		

NOTE: The terminal block and the connector are in parallel. You can, for example, connect the controller to the terminal block and connect the expansion module to the connector.

NOTE: The TM171DWAL2• remote display has an embedded temperature sensor that can be managed as the analog input 1 AIR1.

Input Wiring Diagram Examples

Transducer wiring diagram example:
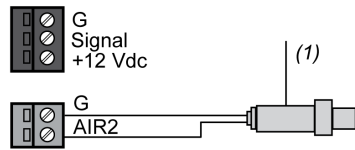
Digital Input wiring diagram example:
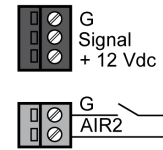
(1) The LAN connector can provide the power supply of the transducer

> **NOTE:** Each connected display has to be accounted for in the power budget of 70 mA available.

Refer to the consumption characteristics, page 89 for the various types of displays and take that into account when powering external devices with the power supply.

Dimension
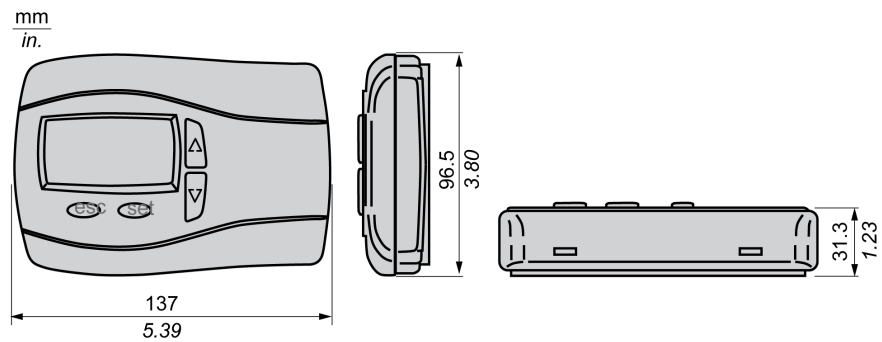
Electrical Characteristics and Wiring Diagrams

What's in This Chapter

Connectors

TM171DLED

Pitch 3.81 mm (0.15 in.) or 3.50 mm (0.14 in.):

mm / in. 9 / 0.35								
mm²	0.14…1.5	0.14…1.5	0.25…1.5	0.25…0.5	2 x 0.08…0.5	2 x 0.08…0.75	2 x 0.25…0.34	2 x 0.5
AWG	26…16	26…16	22…16	22…20	2 x 28…20	2 x 28…20	2 x 24…22	2 x 20

Ø 2,5 mm (0.1 in.)	C	N•m	0.22…0.25
		lb-in	1.95...2.21

TM171DLCD2U and TM171DWAL2•

Pitch 5.08 mm (0.20 in.) or 5.00 mm (0.197 in.):

mm / in. 7 / 0.28								
mm²	0.2…2.5	0.2…2.5	0.25…2.5	0.25…2.5	2 x 0.2…1	2 x 0.2…1.5	2 x 0.25…1	2 x 0.5…1.5
AWG	24…14	24…14	22…14	22…14	2 x 24…18	2 x 24…16	2 x 22…18	2 x 20…16

Ø 3,5 mm (0.14 in.)	C
N•m	0.5…0.6
lb-in	4.42...5.31

Cabling Length

I/O and Serial Lines Maximum Length

Peripheral type	Maximum Length
Embedded sensor PS	10 m (32.81 ft)
Digital inputs	
Analog inputs	
Supply for remote display	
LAN expansion bus	100 m (328 ft).

LAN Expansion Bus Serial Port

Overview

The M171O devices can be connected through the LAN expansion bus.

You can connect:

- 1 controller (TM171O••14R or TM171O••22•)
- 1 expansion module (TM171EO••R) compatible with the controller
- 1 TM171DLED LED remote display
- 1 additional LCD remote display (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U)

Main Functions

The LAN expansion bus is composed by three wires.

The remote displays are powered by the LAN expansion bus.

The total LAN expansion bus length must not exceed 100 m (328 ft).

The LED remote display (TM171DLED) is compatible with the M171O controllers.

The LCD remote displays (TM171DLCD2U, TM171DWAL2L, or TM171DWAL2U) are compatible with the M171O controllers but only one additional LCD remote display can be connected to a controller.

Connector

LAN connector:

BK: Black = GND

BU: Blue = SIGNAL

RD: Red = 12 Vdc

Cables

To connect devices on a LAN expansion bus, use the following cable:

Reference	Description
TM171ACB4OLAN	LAN expansion bus cordset equipped with a 3-pin connector at each end
	2 m (6.56 ft)

The TM171ACB4OLAN cable is delivered with the expansion modules and the remote displays.

To connect 2 devices together, use the LAN cable delivered with remote display or expansion module or order it separately (TM171ACB4OLAN).

To connect more devices, you should use the suitable cables and connector devices.

For LAN expansion bus length > 2 m (6.56 ft), a twisted pair shielded cable must be used.

The total LAN expansion bus length must not exceed 100 m (328 ft).

Wiring Example

For a wiring example, refer to .

User Interface

What's in This Part

Displays and Icons Description

What's in This Chapter

TM171OD•••• / TM171OF•22R / TM171DLED User Interface

Overview

The user interface of the TM171OD•••• / TM171OF•22R controllers have the same functionalities. The TM171DLED is used to perform all operations relating to the connected controller.

TM171OD••••	TM171OF•22R / TM171DLED
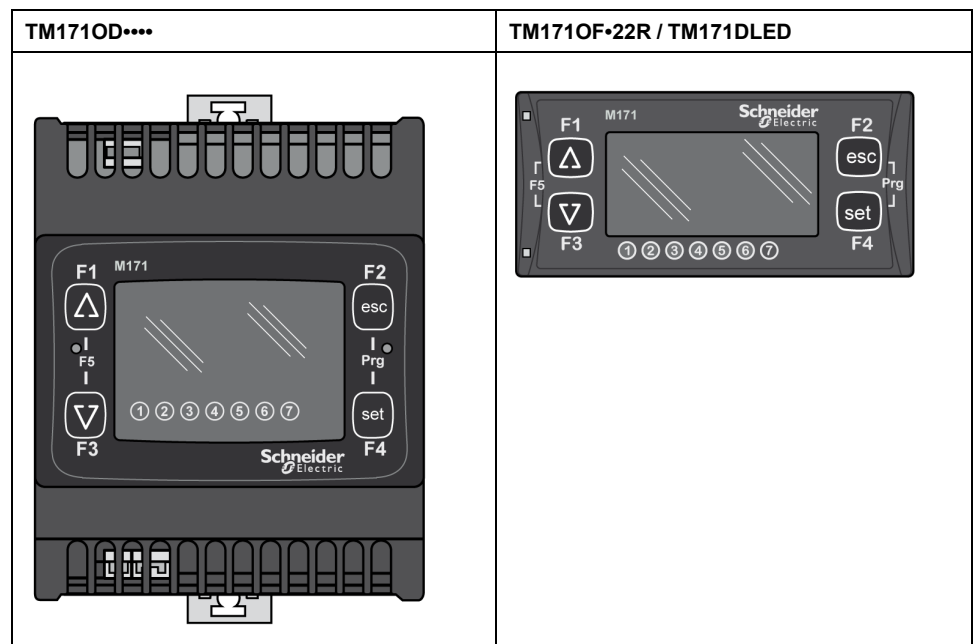
The TM171OB•••• controller and the TM171EO••R expansion modules do not have a user interface.

To operate these devices, use a remote display TM171DLED, TM171DWAL2•, or TM171DLCD2U.

Keys

The following indications refer to the TM171OD•••• / TM171OF•22R / TM171DLED user interface.

Description of keys actions

Key	Press once (press and release)	Long press (press and hold for 3 seconds)[1]
UP	• Increase a value • Go to next label	Function F1
DOWN	• Decrease a value • Go to previous label	Function F3
esc	• Exit without saving modified settings	Function F2

Key	Press once (press and release)	Long press (press and hold for 3 seconds)[(1)]
(escape)	• Go back to previous level	
set	• Confirm value / exit and save modified settings • Move to next level (open folder, subfolder, parameter, value) • Open state menu	Function F4
[**UP + DOWN**]	From the main menu, switch from the BIOS menu to the main display of the IEC Application menu (if present). For more details, refer to SoMachine HVAC software Quick Start, page 9.	-
[**set**+**esc**]	Open programming menu	-

(1)	The long press duration is configurable with the UI26 parameter, page 138.

NOTE: Actions made by the F1…F4 functions depend on the application.

For more details, refer to SoMachine HVAC software Online Help, page 9.

LEDs and Display

All icons must be managed (turned ON, OFF, or flashing) by changing value of the corresponding `sysLocalLeds` array variable inside M171O application.

The `sysLocalLeds[x]` can have the following values:

- 0: icon is OFF
- 1: icon is ON
- 2: icon is flashing

The display has 3 categories of icons:

- States and Operating Modes
- Units of Measure
- Utilities

The display has 3 categories of icons (LEDs):

LEDs description	Icons	Description	Variable to use
LED states and Operating Modes: 		Alarm	`sysLocalLeds[16]`
		Heating	`sysLocalLeds[8]`
		Cooling	`sysLocalLeds[6]`
		Standby	`sysLocalLeds[4]`
		Defrost	`sysLocalLeds[2]`
		Economy	`sysLocalLeds[18]`

LEDs description	Icons	Description	Variable to use
LED Unit of measure: 		Clock (RTC)	`sysLocalLeds[7]`
		Temperature	`sysLocalLeds[5]`
		Pressure	`sysLocalLeds[3]`
	%	Relative humidity% or % of analog output	`sysLocalLeds[1]`
	ABC	Menu	`sysLocalLeds[17]`
LED utilities: 	▼	Utility	`sysLocalLeds[9]`… `sysLocalLeds[15]`

NOTE: Some of the LEDs (for example 0, 1, 3, 5, and 7) cannot be used in the IEC application when BIOS menu is active.

`sysLocalLeds[16]` is dedicated to the colon of the numerical value displayed.

First Power On
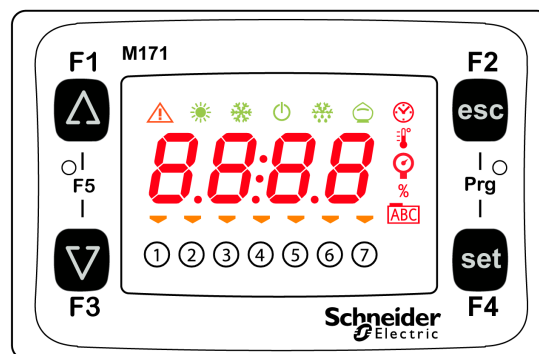
When the M171O / TM171DLED is powered on for the first time, a lamp test is carried out to check its state and operation.

The lamp test continues for a few seconds. During this time, all LEDs and digits flash at the same time.

TM171DLCD2U / TM171DWAL2• User Interface

Overview

The front panel of the remote display serves as user interface and is used to perform the operations required to use a Modicon M171 Optimized Logic Controller.

Remote Display	Keys
TM171DWAL2•	4 keys on the front cover of the controller
TM171DLCD2U	8 keys on the front cover of the controller

These remote displays have no integrated functionalities. After power on, by default, without any application running in the controller, the display is empty. They must be programmed in the IEC application running in the M171O controller.

You can manage:

- The icons, page 112
- The values to display, page 114

TM171DWAL2• and TM171DLCD2U Keys

TM171DWAL2•	TM171DLCD2U

Description of keys actions

Key	Press once (press and release)	Long press (press and hold for 3 seconds)[1]
UP	• Increase a value • Go to next label	Function F1
DOWN	• Decrease a value • Go to previous label	Function F3
esc (escape)	• Exit without saving modified settings • Go back to previous level	Function F2
set	• Confirm value / exit and save modified settings • Move to next level (open folder, subfolder, parameter, value) • Open states menu, page 116	Function F4
[**UP + DOWN**]	From the main menu, switch from the BIOS menu to the main display of the IEC Application menu (if present). For more details, refer to SoMachine HVAC software Quick Start, page 9.	-
[**set +esc**]	Open programming menu, page 119	-
F1[2]	See **UP** key long press	-
F2[2]	See **esc** key long press	-

Key	Press once (press and release)	Long press (press and hold for 3 seconds)[1]
F3[2]	See **DOWN** key long press	-

(1)	The long press duration is configurable with the UI26 parameter, page 138.
(2)	F1, F2, and F3 keys are only on TM171DLCD2U.

NOTE: Actions made by the F1…F4 functions depend on the application.

The KeyLogOutDisplays function is used to read the keys buffer queue.

For more details, refer to SoMachine HVAC software Online Help, page 9.

TM171DWAL2• and TM171DLCD2U Icons on the Display

All icons must be managed (turned ON, OFF, or flashing) by changing value of the corresponding SYSLCDLED array variable inside M171O application.
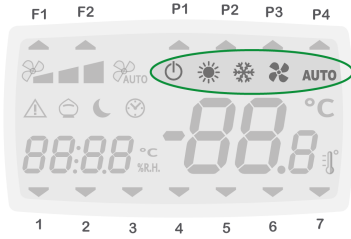
The SYSLCDLED[x] can have the following values:

- 0: icon is OFF
- 1: icon is ON
- 2: icon is flashing

The display has 3 categories of icons:

- States and Operating Modes
- Units of Measure
- Utilities

States and Operating Modes Icons
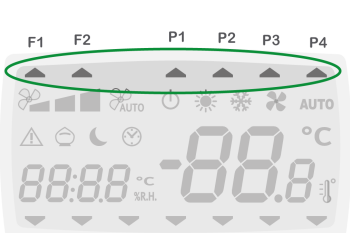
Display	Icons	Description	Variable to use
		Standby	SYSLCDLED[10]
		Heating	SYSLCDLED[11]
		Cooling	SYSLCDLED[12]
		Fan	SYSLCDLED[13]
	AUTO	AUTO	SYSLCDLED[14]
		Alarm	SYSLCDLED[15]
		Economy	SYSLCDLED[16]
		Nightly	SYSLCDLED[17]
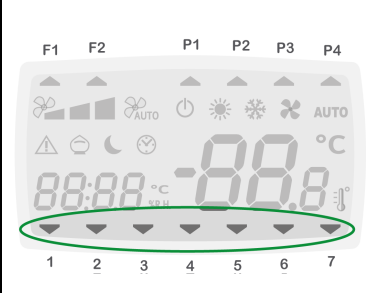
Display	Icons	Description	Variable to use
	(clock icon)	Clock (RTC)	Managed by `WriteClockLCD` function[1]
(display image)	(fan icon)	Fan level 1	`SYSLCDLED[6]`
	(fan level 2 icon)	Fan level 2	`SYSLCDLED[7]`
	(fan level 3 icon)	Fan level 3	`SYSLCDLED[8]`
	(fan auto icon)	Fan auto	`SYSLCDLED[9]`

1 The Clock icon has priority on `SYSLCDLED[24]`/`SYSLCDLED[25]` . For example, if the Clock icon is ON, `SYSLCDLED[24]`/`SYSLCDLED[25]` are forced OFF.

Unit of measure LEDs description
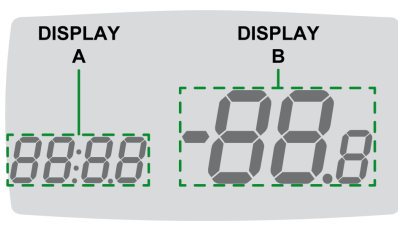
LEDs and Display	Icons	Name	Variable to use
(display image)	°C	Temperature	`SYSLCDLED[25]`[1]
	%R.H.	Relative humidity%	`SYSLCDLED[24]`[1]
(display image)	°C	Temperature	`SYSLCDLED[19]`
	(thermometer icon)	Temperature	`SYSLCDLED[27]`

1 The Clock icon has priority on `SYSLCDLED[24]`/`SYSLCDLED[25]` . For example, if the Clock icon is ON, `SYSLCDLED[24]`/`SYSLCDLED[25]` are forced OFF.

Utilities Icons description.

LEDs and Display	Icons	Name	Variable to use
(display image)	(triangle icon)	F1	`SYSLCDLED[0]`
		F2	`SYSLCDLED[1]`
		P1	`SYSLCDLED[2]`
		P2	`SYSLCDLED[3]`
		P3	`SYSLCDLED[4]`
		P4	`SYSLCDLED[5]`

LEDs and Display	Icons	Name	Variable to use
		1	SYSLCDLED[28]
		2	SYSLCDLED[29]
		3	SYSLCDLED[30]
		4	SYSLCDLED[31]
		5	SYSLCDLED[32]
		6	SYSLCDLED[33]
		7	SYSLCDLED[34]

TM171DWAL2• and TM171DLCD2U Displayed Values

LEDs and Display	Display A	Display B
	4-digits read-out	Read-out with 2 and a half digits and +/- sign Values are always shown in tenths of a degree/bar.
	Can be managed by the functions: • WriteClockLCD • WriteNumLCD • WriteStringLCD	Can be managed by the functions: • WriteNumLCD • WriteStringLCD

For more details, refer to SoMachine HVAC software Online Help, page 9.

Menus

What's in This Chapter

Main Menus

Access to Folders - Menu Structure

Access to folders is organized into menus.

There are 2 main menus:

Menu	Description	Access from main menu
States menu, page 116	The States menu permits to: • Display inputs/outputs • Display and modify the Clock of the controller • Manage the alarms	Press the **set** key
Programming menu, page 119	The Programming menu permits to: • Modify device parameter • Upload/download parameters with TM171AMFK • Enter a password visibility	Press the **set** key and the **esc** key simultaneously

Refer also to BIOS menu, page 115.

BIOS Menu

Access

From the main menu, press the **UP** and **DOWN** keys simultaneously.

Overview

The M171O has a BIOS menu to control the "States" menu and the "Programming" menu.

If there is no IEC application on the device, the M171O displays the message **FrEE**.

Otherwise, the M171O displays the default message of the IEC application, or the default message of the controller if no default values have been set.

Press **UP** and **DOWN** keys (F1+F3) together to access to the BIOS menu.
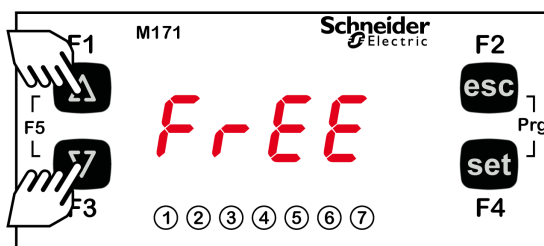
For more details, refer to the SoMachine HVAC software Quick Start, page 9.

States Menu

Overview

The States menu permits to:

- Display inputs/outputs, page 117
- Display and modify the Clock of the controller, page 117
- Display the alarms, page 118

The accessible resources depend on the device (for example dOL6 is only present on TM171OF•22R / TM171OD•••• / TM171OB••••).

Access

From the main menu, press the **set** key.

Structure
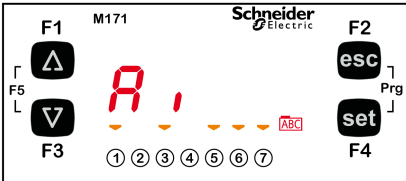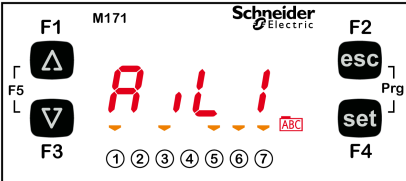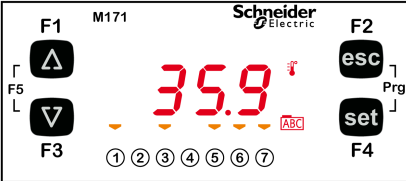
Structure of the States menu:

Subfolders	Possible resources display						Description	Writing access
Ai	AIL1	AiL2	AIL3	AIL4	AIL5	-	Controller analog inputs	-
Ai	AIE1	AiE2	AIE3	AIE4	AIE5	-	Expansion module analog inputs [1]	-
Ai	Air1	Air2	-	-	-	-	Remote display analog inputs	-
di	diL1	diL2	diL3	diL4	diL5	diL6	Controller digital inputs	-
di	diE1	diLE2	diLE3	diLE4	diLE5	diLE6	Expansion module digital inputs [1]	-
AO	tCL1	AOL1	AOL2	AOL3	AOL4	AOL5	Controller analog outputs	-
AO	tCE1	AOE1	AOE2	AOE3	AOE4	AOE5	Expansion module analog outputs [1]	-
dO	dOL1	dOL2	dOL3	dOL4	dOL5	dOL6	Controller digital outputs	-
dO	dOE1	dOE2	dOE3	dOE4	dOE5	dOE6	Expansion module digital outputs [1]	-
CL	HOUr	dAtE	YEAr	-	-	-	Clock	✓
AL	Er45	Er46	-	-	-	-	Alarms	-

[1]		Only if TM171EO••R expansion module is present

Display an Inputs/Outputs (AiL, diL, tCL1/AOL, dOL)

Follow the procedure to display Inputs/Outputs:

Step	Action	Result
1	From the main display, press the **set** key: 	The state menu is opened. The label of the first subfolder is displayed (Ai in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the folder required.	-
3	Press **set** key to open the folder.	The label of the first subfolder is displayed (AiL1 in this case):
4	Press **set** key to open the folder.	The value of the parameter is displayed: **NOTE:** The icon lights up to indicate that the value shown is in degrees Celsius.
5	Press **esc** key to go back to the main display.	-
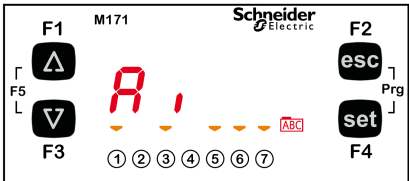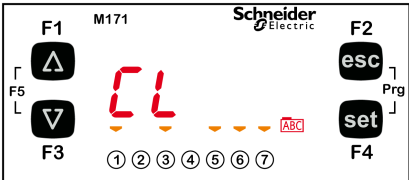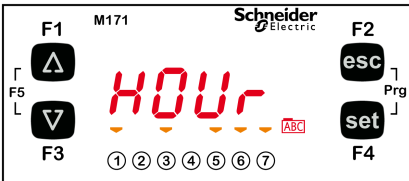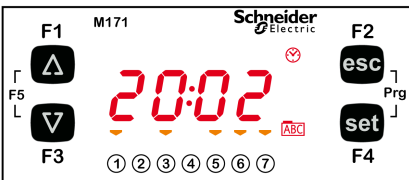
For digital inputs (and analog inputs configured as digital), the value is:

Value	Logical state	Physical state
0	Not active	Input open
1	Active	Input short-circuited to ground

Setting the Clock (CL)
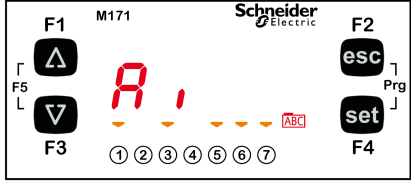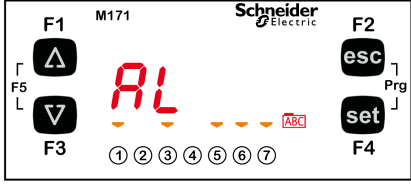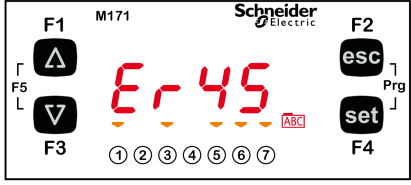
The M171O has a clock (RTC) to run the alarm history just like a programmable chronothermostat. Instructions are provided below on how to set the time: the same procedure applies to modify the date and year.

Follow the procedure to set the time:

Step	Action	Result
1	From the main display, press to the **set** key:	The state menu is opened.
		The label of the first subfolder is displayed (**Ai** in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the **CL** folder.	**CL** is displayed:
3	Press **set** key to open the folder.	The label of the first subfolder is displayed (**H0Ur** in this case):
4	Press **UP** and **DOWN** keys to select the time, date, or year.	-
5	Press and hold **set** key for about 3 seconds to open the modification menu.	The value of the selected parameter is displayed (the hour in this case):
6	Press **UP** and **DOWN** keys to enter the required value.	-
7	Press **set** key to validate.	-
8	Press **esc** key to go back to the main display.	-

Display the Alarm (AL)

Follow the procedure to the alarms:

Step	Action	Result
1	From the main display, press **set** key:	The state menu is opened. The label of the first subfolder is displayed (**Ai** in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the **AL** folder.	**AL** is displayed:
3	Press **set** key to open the **AL** folder.	The label of the first active alarm is displayed (if it exists). In this example, the first alarm is Er45:
4	Use **UP** and **DOWN** keys to scroll any other alarms. **NOTE:** The menu is not cyclical: • Use the **UP** key to display the next alarm • Use the **DOWN** key to display the previous alarm	-
5	Press **esc** key to go back to the main display.	-

Programming Menu

Overview

The Programming menu permits to:

- Modify device parameters, page 120
- Upload/download parameters with TM171AMFK, page 121
- Enter a password visibility, page 122

Access

From the main menu, press the **set** key and the **esc** key simultaneously

Structure

The Programming menu has three folders:

Folders	Subfolders	Possible action
Parameters menu (**PAr** folder)	**CL** **Cr** **CE** **CF** **Ui**	Modify device parameters, page 120.
Functions menu (**FnC** folder)	CC CC\UL CC\dL CC\Fr	Upload/download parameters with TM171AMFK, page 121.
Password menu (**PASS** folder)	-	Enter a password visibility, page 122.
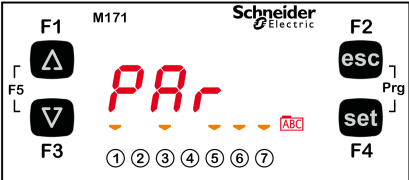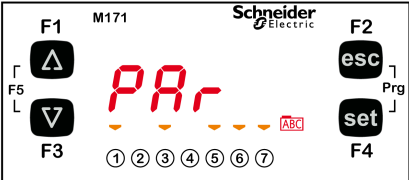
Parameters (PAr)
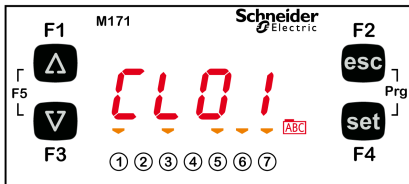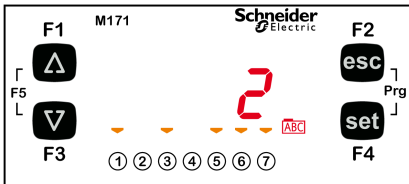
This folder permits you to modify the parameters of the device.

For more details, refer to the parameter list, page 130.

The example presents how to configure the parameter CL01 (PAr/CL/CL01).

Follow the procedure to modify a parameter:
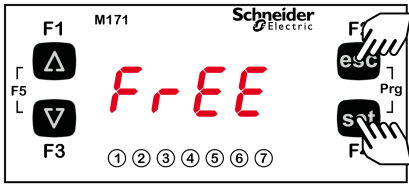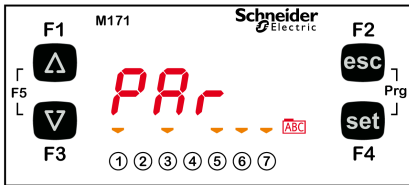
Step	Action	Result
1	From the main display, press the **set** key and the **esc** key simultaneously to open the programming menu: 	The programming menu is opened. The label of the first subfolder is displayed (**PAr** in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the **PAr** folder.	-
3	Press **set** key to open the Parameters menu.	The label of the first subfolder is displayed (**CL** in this case):
4	If needed, press the **UP** and **DOWN** keys to scroll the other labels until you find the required one.	-
5	Press **set** key to open the folder.	The label of the first subfolder is displayed (**CL00** in this case).

Step	Action	Result
6	Press the **UP** and **DOWN** keys to scroll through the various parameters until you find the required one (**CL01** is this case).	**CL01** is displayed:
7	Press **set** key to view the value of the parameter (**CL01** in this case).	For parameter **CL01**, the value shown is 2: **NOTE:** The icon lights up to indicate that the value shown is in degrees Celsius.
8	Press the **UP** and **DOWN** keys to modify this value.	-
9	Press **set** key to validate the new value of the parameter. **NOTE:** Press **esc** to take you back to the previous folder without saving the value entered.	-
10	Press **esc** key to go back to the main display.	-

Functions (FnC)

This folder permits you to upload, download, or format parameters with the TM171AMFK programming stick.

Follow the procedure to download parameters:
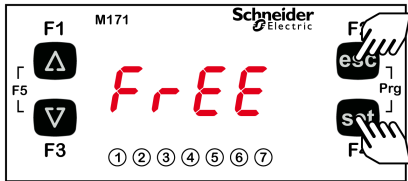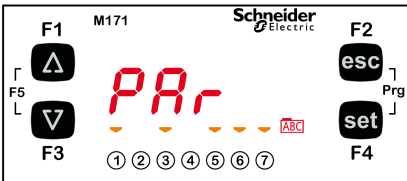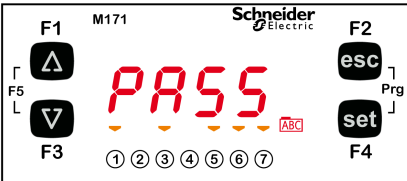
Step	Action	Result
1	From the main display, press the **set** key and the **esc** key simultaneously to open the programming menu:	The programming menu is opened. The label of the first subfolder is displayed (**PAr** in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the **FnC** folder.	-
3	Press **set** key to open the Function menu.	The label of the first subfolder is displayed (**CC** in this case).
4	Press **set** key to open the **CC** menu.	The label of the first subfolder is displayed (**DL** in this case).

5	Press the **UP** and **DOWN** keys to scroll the other labels until you find the desired folder:
	   • **UL**: upload
	   • **dL**: download
	   • **Fr**: format
		-

Step	Action	Result
6	Press **set** key to launch the selected function (download of the parameters in the TM171AMFK programming stick in this example).	The selected function starts.
7	Wait around 20 seconds.	**YES** is displayed if the function is successful. **Err** is displayed if the function is not successful.
8	Press **esc** key to go back to the main display.	-

Entering a Password (PASS)

Folder and parameters visibility is protected by a password.

Follow the procedure to enter a visibility password:

Step	Action	Result
1	From the main display, press the **set** key and the **esc** key simultaneously to open the programming menu: 	The programming menu is opened. The label of the first subfolder is displayed (**PAr** in this case):
2	Press **UP** and **DOWN** keys to scroll the other labels until you find the **PASS** folder.	**PASS** is displayed:
3	Press **set** key to open the folder.	-
4	Press **UP** and **DOWN** keys to modify the password (installation or manufacturer). The installation password is defined in the UI27 parameter (default value = 1). The manufacturer password is defined in the UI28 parameter (default value = 2).	-
5	Press **set** key to validate the password.	-
6	Press **esc** key to go back to the main display.	-

You can display the parameters and modify the value of the parameters.

For details, refer to visibility of the parameters, page 132.

Configuration Physical I/O

From time to time, new input modules, output modules, or other devices are made available that are not documented in the following information. For information on new devices, contact your local Schneider Electric representative.

NOTICE

INOPERABLE EQUIPMENT

Update the controller firmware to the latest version every time you install a newly released Input/Output expansion module or other device to this equipment.

Failure to follow these instructions can result in equipment damage.

> **NOTE:** For more information on how to update the controller firmware, contact your local Schneider Electric representative.

Applying incorrect current or voltage levels on analog inputs and outputs could damage the electronic circuitry. Further, connecting a current input device to an analog input configured for voltage, and vice versa, could damage the electronic circuitry.

NOTICE

INOPERABLE EQUIPMENT

• Do not apply voltages above 11 Vdc to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-10V input.

• Do not apply current above 25 mA to the analog inputs of the controller or Input/Output expansion module when analog input is configured as 0-20 mA or 4-20 mA input.

• Do not mismatch applied signal with analog input configuration.

Failure to follow these instructions can result in equipment damage.

Digital I/O

What's in This Chapter

Digital I/O

Digital Inputs

The digital inputs are identified as DI1…DI6.

For details on types and number of inputs and outputs for each device, refer to:

- Device Description TM171O••14R, page 44
- Device Description TM171O••22•, page 52
- Device Description TM171OD••••, page 97

Some devices have analog inputs that can be configured as dry contact digital inputs. For more details, refer to the configuration of analog inputs, page 125.

Digital Output

Digital outputs are identified as DO1…DO6.

Two types of digital outputs are available:

- High voltage outputs, relays.
- The low voltage (SELV), open collector outputs.

For details on types and number of inputs and outputs for each device, refer to:

- Device Description TM171O••14R, page 44
- Device Description TM171O••22•, page 52

Analog I/O

What's in This Chapter

Analog Inputs

Overview

Analog inputs are identified as AI1…AI5.

Depending on the device, analog inputs can be configured as:

- Dry contact digital input,
- NTC,
- Current signal input,
- Voltage signal input,
- Pt1000.

For details on types and number of inputs and outputs for each device, refer to:

- Device Description TM171O••14R, page 44
- Device Description TM171O••22•, page 52
- Device Description TM171D•••••, page 97

TM171O••••• Controller Analog Inputs

According to the physical resources wired (probe, dry contact digital input, voltage signal, current signal), inputs must be configured using the related parameters.

Analog inputs type can be configured as specified in the following table:

Analog input	Parameter	Not configured	Dry contact digital input	NTC	4…20 mA, 0…20 mA, 0…10 Vdc, 0…5 Vdc, or 0…1 Vdc	Pt1000[1]
AiL1	CL00				-	✓
AiL2	CL01				-	✓
AiL3	CL02	✓	✓	✓	✓	-
AiL4	CL03				✓	-
AiL5	CL04				-	✓
(1)	Only for TM171O••14R.					

Analog inputs can be scaled using parameters:

Analog input	Parameter	Description	Range	Unit
AiL3	CL10	Analog input AiL3 full-scale value	CL11…999.9	°C / Bar
AiL3	CL11	Analog input AiL3 start of scale value	-99.9…CL10	
AiL4	CL12	Analog input AiL4 full-scale value	CL13…999.9	
AiL4	CL13	Analog input AiL4 start of scale value	-99.9…CL12	

Analog inputs can be calibrated using parameters:

Analog input	Parameter	Description	Range	Unit
AiL1	CL20	Analog input AiL1 differential	-12.0…12.0	°C
AiL2	CL21	Analog input AiL2 differential		
AiL3	CL22	Analog input AiL3 differential		°C / Bar
AiL4	CL23	Analog input AiL4 differential		
AiL5	CL24	Analog input AiL5 differential		°C

For details on the values and characteristics of parameters, refer to the CL Parameters, page 133.

TM171EO••R Expansion Analog Inputs

According to the physical resources wired (probe, digital input, voltage signal, current signal), inputs must be configured using the related parameters.

Inputs type parameters can be configured as specified in the following table:

Analog input	Parameter	Not config-ured	Dry contact digital input	NTC sensor	4…20 mA, 0…20 mA, 0…10 Vdc, 0…5 Vdc, or 0…1 Vdc	Pt1000[1]
AiE1	CE00	✓	✓	✓	-	✓
AiE2	CE01					
AiE3	CE02				✓	
AiE4	CE03					-
AiE5	CE04				-	

(1)	TM171O••14R / TM171EO14R only

Analog inputs can be scaled using parameters:

Analog input	Parameter	Description	Range	Unit
AiE3	CE10	Analog input AiE3 full-scale value	CE11…999.9	°C / Bar
AiE3	CE11	Analog input AiE3 start of scale value	-99.9…CE10	°C / Bar
AiE4	CE12	Analog input AiE4 full-scale value	CE13…999.9	°C / Bar
AiE4	CE13	Analog input AiE4 start of scale value	-99.9…CE12	°C / Bar

Analog inputs can be calibrated using parameters:

Analog input	Parameter	Description	Range	Unit
AiE1	CE20	Analog input AiE1 differential	-12.0…12.0	°C
AiE2	CE21	Analog input AiE2 differential		°C
AiE3	CE22	Analog input AiE3 differential		°C / Bar
AiE4	CE23	Analog input AiE4 differential		°C / Bar
AiE5	CE24	Analog input AiE5 differential		°C

For details on the values and characteristics of parameters, refer to the CE Parameters, page 135.

TM171DWAL2• / TM171DLCD2U Display Analog Inputs

According to the physical resources wired (probe, dry contact digital input, current signal), inputs must be configured using the related parameters.

Inputs type parameters can be configured as specified in the following table:

Analog input	Parameter	Not configured	Dry contact digital input	NTC	4…20 mA, or 0…20 mA
AiR1	Cr00	✓	-	✓	-
AiR2	Cr01		✓		✓

Analog inputs can be scaled using parameters:

Analog input	Parameter	Description	Range	Unit
Air2	Cr10	Analog input Air2 full-scale value	Cr11…999.9	°C / Bar
Air2	Cr11	Analog input Air2 start of scale value	-99.9…Cr10	°C / Bar

Analog inputs can be calibrated using parameters:

Analog input	Parameter	Description	Range	Unit
Air1	Cr20	Analog input Air1 differential	-12.0…12.0	°C
Air2	Cr21	Analog input Air2 differential		°C / Bar

For details on the values and characteristics of parameters, refer to the Cr Parameters, page 136.

Analog Outputs

Overview

Analog outputs are identified as TC1, TC2, AO1…AO5.

Depending on the device, analog outputs can be configured as:

- Open collector PWM/PPM output,
- Digital output,
- Low voltage (SELV) current signal output,
- Low voltage (SELV) voltage signal output,
- TRIAC output (High voltage output)

TRIAC outputs (TC1 and TC2 only for TM171ODM22S) are high voltage outputs.

The output can be configured for proportional operation (constant speed variation) or as ON/OFF. The TRIAC TC1 output, when partialized, suppresses the half-wave at the zero-crossing.

⚠ **WARNING**

UNINTENDED EQUIPMENT OPERATION

Do not install contactors or other interposing relays downstream from Triac outputs.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For details on types and number of inputs and outputs for each device, refer to:

- Device Description TM171O••14R, page 44
- Device Description TM171O••22•, page 52

TM171O••••• Controller Analog Outputs

According to the physical resources wired, outputs must be configured using the related parameters.

Analog outputs type can be configured as specified in the following table:

Analog output	Parameter	Open Collector PWM/PPM	Dry contact digital Input	0…10 Vdc	0…20 mA 4…20 mA	TRIAC 2 A 240 Vac
TCL1	CL70	-	-	-	-	✓
TCL2	CL72	-	-			✓
AOL1	CL71	✓	✓ [1]		-	-
AOL2	CL72	✓	✓ [1]			
AOL3	-	-	-	✓		
AOL4	-	-	-	✓		
AOL5	CL60				✓	
[1] TM171•••14R only.						

Analog outputs phase shift can be set using parameters:

Analog output	Parameter	Description	Range	Unit
TCL1	CL73	Analog output TCL1 phase shift	0…90	Deg (Degrees)
TCL2	CL75	Analog output TCL2 phase shift		
AOL1	CL74	Analog output AOL1 phase shift		
AOL2	CL75	Analog output AOL2 phase shift		

Analog outputs pulse time can be set using parameters:

Analog output	Parameter	Description	Range	Unit
TCL1	CL76	Analog output TCL1 pulse time	5…40	Num 1 unit = 69.4 µsec
TCL2	CL78	Analog output TCL2 pulse time		
AOL1	CL77	Analog output AOL1 pulse time		
AOL2	CL78	Analog output AOL2 pulse time		

For details on the values and characteristics of parameters, refer to the CL Parameters, page 133.

TM171EO••R Expansion Analog Outputs

According to the physical resources wired, outputs must be configured using the related parameters.

Analog outputs type can be configured as specified in the following table (depending on product):

Analog output	Parameter	Open Collector PPM	Dry contact digital input	0…10 Vdc	0…20 mA 4…20 mA	TRIAC 2 A 240 Vac
TCE1	CE70	-	-	-	-	✓
AOE1	CE71	✓	✓			-

Analog output	Parameter	Open Collector PPM	Dry contact digital input	0…10 Vdc	0…20 mA 4…20 mA	TRIAC 2 A 240 Vac
AOE2	CE72					
AOE3	-	-	-	✓		
AOE4						
AOE5	CE60				✓	

Analog outputs phase shift can be set using parameters:

Analog output	Parameter	Description	Range	Unit
TCE1	CE73	Analog output TCL1 phase shift	0…90	Deg (Degrees)
AOE1	CE74	Analog output AOL1 phase shift		
AOE2	CE75	Analog output AOL2 phase shift		

Analog outputs pulse time can be set using parameters:

Analog output	Parameter	Description	Range	Unit
TCE1	CE76	Analog output TCL1 pulse time	5…40	Num 1 unit = 69.4 µsec
AOE1	CE77	Analog output AOL1 pulse time		
AOE2	CE78	Analog output AOL2 pulse time		

For details on the values and characteristics of parameters, refer to the CE Parameters, page 135.

Parameters

Parameters

What's in This Chapter

Overview

Overview

Parameters are used to configure a Modicon M171 Optimized Logic Controller.

They can be modified with:

- Keys on:
  - TM171OF•22R / TM171OD•••• front panel
  - TM171DLED / TM171DWAL2• / TM171DLCD2U displays
- The TM171AMFK programming stick
- PC with SoMachine HVAC software (TM171SW)
- Modbus SL communication

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
After any BIOS parameter modification, power cycle the device.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Parameters / Visibility Table, Folder Visibility Table, and Client Table

The three following tables list all information required to read, write, and decode all accessible resources in the device.

Table	Description
Parameter table, page 133	It contains all device configuration parameters stored in the nonvolatile memory of the device, including visibility information
Folders table, page 139	It lists the visibility of all parameter folders
Client table, page 140	It includes all I/O and alarm status resources available in the volatile memory of the device

Description of columns:

Column	Description
FOLDER	Indicates the label of the folder containing the parameter.
LABEL	Indicates the label used to display the parameters in the device menu.
VAL PAR ADDRESS	Indicates the address of the Modbus register containing the resource to access.
DATA SIZE	Indicates the size of the data in bits. The dimension is always in WORD = 16 bits.

Column	Description
CPL	When the field indicates "Y", the value read by the register requires conversion because the value represents a number with a sign. In the other cases, the value is positive or null.
	To carry out conversion, proceed as follows:
	• If the value in the register is from 0 to 32 767, the result is the value itself (zero and positive values).
	• If the value in the register is from 32 768 to 65 535, the result is the value of the register -65 536 (negative values).
EXP	When the field indicates -1, the value read from the register is divided by 10 (value/10) to convert it to the values given in the RANGE and DEFAULT columns and the unit of measure specified in the U.M. column.
	Example: parameter CL04 = 50.0. Column EXP = -1:
	• The value read by the device / SoMachine HVAC software is 50.0
	• The value read from the register is 500 → 500/10 = 50.0
VIS PAR ADDRESS	Same as above. In this case, the parameter visibility value is in the Modbus register address. By default, all parameters have:
	• Data size = WORD
	• Range = 0…3. Refer to parameters visibility description, page 132
	• U.M. = num
VIS PAR VALUE	Indicates parameter / folder visibility:
	• 0 = Never visible. Not visible from device
	• 1 = Level 1 – refer to parameter Ui27, page 138
	• 2 = Level 2 – refer to parameter Ui28, page 138
	• 3 = Always visible
R/W	Indicates if resources are read/write, read-only or write-only:
	• R = Read-only resource
	• W = Write-only resource
	• RW = Read/write resource
RANGE	Describes the interval of values that can be assigned to the parameter. It can be correlated with other equipment parameters (indicated with the parameter label).
	NOTE: If the value is outside the limits specified for the parameter, instead of the actual value, the value of the limit not respected is displayed.
DEFAULT	Indicates the factory setting for the reference of the device. In the following table, the hardware reference can be presumed to be TM171OF•22R.
U.M.	Measurement unit for values converted according to the rules indicated in the CPL and EXP columns.
	Measurement unit listed depends on the application developed.

Parameter Visibility

Visibility and value of Parameters

Depending on the reference, some configuration parameters may not be visible and/or of any significance given that the associated resource is not present.

Four levels of visibility can be set by assigning suitable values to parameters and folders:

Value	Level of visibility	Password required
3	Parameters or folders visible	No password required.
2	Manufacturer level These parameters or folders can only be viewed by entering the password defined in the parameter UI28, page 138. Parameters declared as visible (3), parameters visible at the manufacturer level (2), and installer level (1) are visible.	Password-protected objects are visible only if the correct password is entered (installer or manufacturer) via the procedure entering a password, page 122.

Value	Level of visibility	Password required
1	Installation level These parameters or folders can only be viewed by entering the password defined in the parameter UI27, page 138. Parameters declared as visible (3) and parameters visible at the installer level (1) are visible.	
0	Parameters or folders NOT visible.	N/A

When not indicated otherwise, the parameter is visible and modifiable, unless customized settings have configured via serial.

Parameters and folder visibility can both be controlled. Refer to the Folders table, page 139.

If folder visibility is modified, the new setting applies to all parameters in the folder.

Parameters

Folders

The following sections analyze each parameter, divided into categories (folders):

Folder label	Acronym meaning (label)	Parameters of
CL	Configuration Local, page 133	Controller I/O configuration
CE	Configuration Expansion, page 135	Expansion I/O configuration
Cr	Configuration display, page 136	Display I/O configuration
CF	Configuration, page 137	Configuration
UI	User interface, page 138	User interface

Parameters Data Size

The data size of each parameter is 16 bits (WORD).

CL Parameters

Configuration Local parameters

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
CL00	53304	53585	2	RW	Type of analog input AiL1: • 0 = Probe not configured • 1 = Digital Input • 2 = NTC • 3…7 = NOT USED • 8= Pt1000 (TM171•••14R only)	-	0…8	0	-	Num
CL01	53305	53586	2	RW	Type of analog input AiL2	-	0…8	0	-	Num

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
					See CL00.					
CL02	53306	53587	2	RW	Type of analog input AiL3: • 0 = Probe not configured • 1 = Digital Input • 2 = NTC • 3 = 4…20 mA • 4 = 0…10 V • 5 = 0…5 V • 6 = 0…1 V • 7 = 0…20 mA	-	0…7	0	-	Num
CL03	53307	53588	2	RW	Type of analog input AiL4 See CL02.	-	0…7	0	-	Num
CL04	53308	53589	2	RW	Type of analog input AiL5 See CL00.	-	0…8	0	-	Num
CL10	15649	53590	1	RW	Analog input AiL3 full-scale value	Y	CL11…9999	500	-1	°C/Bar
CL11	15655	53591	1	RW	Analog input AiL3 start of scale value	Y	-999…CL10	0.0	-1	°C/Bar
CL12	15650	53592	1	RW	Analog input AiL4 full-scale value	Y	CL13…9999	500	-1	°C/Bar
CL13	15656	53593	1	RW	Analog input AiL4 start of scale value	Y	-999…CL12	0	-1	°C/Bar
CL20	53334	53594	1	RW	Analog input AiL1 differential	Y	-120…120	0	-1	°C
CL21	53335	53595	1	RW	Analog input AiL2 differential	Y	-120…120	0	-1	°C
CL22	53336	53596	1	RW	Analog input AiL3 differential	Y	-120…120	0	-1	°C/Bar
CL23	53337	53597	1	RW	Analog input AiL4 differential	Y	-120…120	0	-1	°C/Bar
CL24	53338	53598	1	RW	Analog input AiL5 differential	Y	-120…120	0	-1	°C
CL60	53344	53599	2	RW	Type of analog output AOL5: • 0 = 4…20 mA • 1 = 0…20 mA • 2 = 0…10 V on dedicated references only	-	0…2	0	-	Num
CL70	53346	53600	0	RW	Enable TRIAC output TCL1: • 0 = TRIAC output disabled (TM171O••22R) or used as digital as DO6 (TM171ODM22S) • 1 = TRIAC output enabled • 2 = Real PWM	-	0…2	0	-	Num
CL71	53347	53601	2	RW	Enable analog output AOL1: • 0 = Output configured as digital • 1 = External TRIAC PPM driver (See CL74 and CL77) • 2 = REAL PWM (to be used with target function PWM_Frequency)	-	0…2	0	-	Num
CL72	53348	53602	2	RW	Enable analog output AOL2: • 0 = TRIAC output disabled (TM171ODM22S only) or Output configured as digital • 1 = Output configured as TRIAC (=TC2) in TM171ODM22S only, or external TRIAC PPM driver (see CL75-CL78)	-	0…2	0	-	Num

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
					• 2 = REAL PWM (with target function PWM_Frequency, not used in TM171ODM22S)					
CL73	53349	53603	0	RW	Analog output TCL1 phase shift	-	0…90	27	-	Deg (Degrees)
CL74	53350	53604	2	RW	Analog output AOL1 phase shift	-	0…90	27	-	
CL75	53351	53605	2	RW	Analog output AOL2 phase shift	-	0…90	27	-	
CL76	53352	53606	0	RW	Analog output TCL1 pulse time	-	5…40	10	-	Num (1 unit = 69.4 µsec)
CL77	53353	53607	2	RW	Analog output AOL1 pulse time	-	5…40	10	-	
CL78	53354	53608	2	RW	Analog output AOL2 pulse time	-	5…40	10	-	

CE Parameters

Configuration Expansion parameters

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
CE00	53792	53615	2	RW	Type of analog input AIE1: • 0 = Probe not configured • 1 = Digital Input • 2 = NTC	-	0…2	0	-	Num
CE01	53793	53616	2	RW	Type of analog input AIE2 See CE00.	-	0…2	0	-	Num
CE02	53794	53617	2	RW	Type of analog input AIE3: • 0 = Probe not configured • 1 = Digital Input • 2 = NTC • 3 = 4…20 mA • 4 = 0…10 Vdc • 5 = 0…5 Vdc • 6 = 0…1 Vdc • 7 = 0…20 mA	-	0…7	0	-	Num
CE03	53795	53618	2	RW	Type of analog input AIE4 See CE02.	-	0…7	0	-	Num
CE04	53796	53619	2	RW	Type of analog input AIE5 See CE00.	-	0…2	0	-	Num
CE10	15893	53620	1	RW	Analog input AIE3 full-scale value	Y	CE11…9999	500	-1	°C /Bar
CE11	15899	53621	1	RW	Analog input AIE3 start of scale value	Y	-999…CE10	0	-1	°C /Bar
CE12	15894	53622	1	RW	Analog input AIE4 full-scale value	Y	CE13…9999	500	-1	°C /Bar
CE13	15900	53623	1	RW	Analog input AIE4 start of scale value	Y	-999…CE12	0	-1	°C /Bar
CE20	53822	53624	1	RW	Analog input AIE1 differential	Y	-120…120	0	-1	°C /Bar

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
CE21	53823	53625	1	RW	Analog input AIE2 differential	Y	-120…120	0	-1	°C /Bar
CE22	53824	53626	1	RW	Analog input AIE3 differential	Y	-120…120	0	-1	°C /Bar
CE23	53825	53627	1	RW	Analog input AIE4 differential	Y	-120…120	0	-1	°C /Bar
CE24	53826	53628	1	RW	Analog input AIE5 differential	Y	-120…120	0	-1	°C
CE60	53832	53629	2	RW	Type of analog output AOE5: • 0 = 0…20 mA • 1 = 4…20 mA	-	0…1	0	-	Num
CE70	53834	53630	0	RW	Enable analog output TCE1: • 0 = TM171EO22R • 1 = not used	-	0…1	1	-	Num
CE71	53835	53631	2	RW	Enable analog output AOE1: • 0 = Output configured as digital • 1 = External TRIAC PPM driver (see CE74 and CE77)	-	0…1	0	-	Num
CE72	53836	53632	2	RW	Enable analog output AOE2 • 0 = Output configured as digital • 1 = External Triac PPM driver (see CE75 and CE78)	-	0…1	0	-	Num
CE73	53837	53633	0	RW	Analog output TCE1 phase shift	-	0…90	27	-	Deg (Degrees)
CE74	53838	53634	2	RW	Analog output AOE1 phase shift	-	0…90	27	-	
CE75	53839	53635	2	RW	Analog output AOE2 phase shift	-	0…90	27	-	
CE76	53840	53636	0	RW	Analog output TCE1 pulse time	-	5…40	10	-	69 µsec
CE77	53841	53637	2	RW	Analog output AOE1 pulse time	-	5…40	10	-	69 µsec
CE78	53842	53638	2	RW	Analog output AOE2 pulse time	-	5…40	10	-	69 µsec

Cr Parameters

Configuration Display parameters

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
Cr00	53760	53609	2	RW	Type of local analog input AIR1: • 0 = Probe not configured • 1 = Not used • 2 = NTC	-	0…2	0	-	Num
Cr01	53761	53610	2	RW	Type of analog input AIR2: • 0 = Probe not configured • 1 = Digital Input • 2 = NTC • 3 = 4…20 mA • 4…6 = Not used • 7 = 0…20 mA	-	0…7	0	-	Num

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
Cr10	15874	53611	1	RW	Local analog input AIR2 full-scale value	Y	Cr11…9999	0	-1	Num
Cr11	15876	53612	1	RW	Local analog input AIR2 start of scale value	Y	-999…Cr10	0	-1	Num
Cr20	53770	53613	1	RW	Local analog input AIR1 differential	Y	-12.0…12.0	0.0	-1	°C
Cr21	53771	53614	1	RW	Local analog input AIR2 differential	Y	-12.0…12.0	0.0	-1	°C/Bar

CF Parameters

Configuration parameters

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
CF00	53264	//	//	RW	Select COM0 (LAN) communication channel protocol: • 2 = Modbus SL • 3 = LAN **NOTE:** If CF00=2, parameters CF35/CF36/CF37 should be configured	-	2…3	3	-	Num
CF01	53265	53639	2	RW	Select COM1 (TTL) communication channel protocol: • 0 = Schneider Electric (CF20/CF21 should be configured) • 1 = Modbus (CF31/CF32 should be configured) COM1 = TTL/RS485 (TM171O•M••• only): cannot be used simultaneously	-	0…1	1	-	Num
CF20	53272	53640	1	RW	Schneider Electric protocol controller address	-	0…14	0	-	Num
CF21	53273	53641	1	RW	CF20= device index in family (values from 0 to 14) CF21 = device family (values valid from 0 to 14) The pair of values CF20 and CF21 represent the network address of the device and is indicated as FF.DD (where FF=CF21 and DD=CF20).	-	0…14	0	-	Num
CF30	53274	53642	3	RW	COM1 Modbus protocol controller address **NOTE:** 0 (zero) is not included	-	1…255	1	-	Num
CF31	53275	53643	3	RW	COM1 Modbus protocol Baudrate: • 0…2 = not used • 3 = 9600 baud • 4 = 19200 baud • 5 = 38400 baud* • 6 = 57600 baud* • 7 = 115200 baud* *: RS-485: not supported	-	0…7	3	-	Num

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
CF32	53276	53644	3	RW	COM1 Modbus protocol parity: • 1 = EVEN • 2 = NONE • 3 = ODD	-	1…3	1	-	Num
CF35	53277	//	//	RW	COM0 Modbus protocol controller address (LAN) **NOTE:** 0 (zero) is not included	-	1…255	1	-	Num
CF36	53282	//	//	RW	COM0 Modbus protocol Baudrate: • 0…2 = Reserved • 3 = 9600 baud • 4 = 19200 baud • 5…7 = Reserved	-	0…7	3	-	Num
CF37	53283	//	//	RW	COM0 Modbus protocol parity: • 1 = EVEN • 2 = NONE • 3 = ODD	-	1…3	1	-	Num
CF39	53287	//	//	RW	Modbus Master COM select • 0 = COM0 (LAN) • 1 = COM1 (TTL/RS485) **NOTE:** Only for msk542_10 or greater	-	0,1	1	-	Num
CF43	//	//	//	//	Firmware screen (Mask)	//	0…999	412	//	Num
CF44	//	//	//	//	Firmware release	//	0…999	//	//	Num
CF50	53456	53645	0	RW	RTC present • 0 = RTC not present • 1 = RTC present	-	0…1	0	-	Num
CF60	15639	53646	3	RW	Client code 1 Parameter for exclusive use of the customer/user. The client can assign these parameters values that for example, identify the type and/or reference of the system, its configuration, and so on.	-	0…999	0	-	Num
CF61	15640	53647	3	RW	Client code 2 See CF60.	-	0…999	0	-	Num

UI Parameters

User Interface parameters

LABEL	VAL PAR ADDRESS	VIS PAR ADDRESS	VIS PAR VALUE	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
UI26	15715	53648	2	RW	Key hold time to enable function	-	0…999	350	-	4 ms
UI27	15744	53649	1	RW	Installation password When enabled (value other than zero), constitutes the password for access to parameters which visibility = 1.	-	0…255	1	-	Num
UI28	15745	53650	2	RW	Manufacturer password When enabled (value other than zero), constitutes the password for access to parameters which visibility = 2.	-	0…255	2	-	Num

Folder Visibility Table

Folder Visibility Table

LABEL	AD-DRESS	R/W	DESCRIPTION	DATA SIZE	RANGE	VIS. PAR. VALUE	U.M.
_VisCarStati_Ai	53520	RW	Ai folder visibility	WORD	0…3	3	Num
_VisCarStati_di	53521	RW	Visibility of folder	WORD	0…3	3	Num
_VisCarStati_AO	53522	RW	AO folder visibility	WORD	0…3	3	Num
_VisCarStati_dO	53523	RW	dO folder visibility	WORD	0…3	3	Num
_VisCarProgPar	53525	RW	PAr folder visibility	WORD	0…3	3	Num
_VisCarFnC	53526	RW	FnC folder visibility	WORD	0…3	3	Num
_VisCarProgPASS	53527	RW	PASS folder visibility	WORD	0…3	3	Num
_VisCarPrCL	53578	RW	Par\CL folder visibility	WORD	0…3	1	Num
_VisCarPrCr	53579	RW	Par\Cr folder visibility	WORD	0…3	1	Num
_VisCarPrCE	53580	RW	Par\CE folder visibility	WORD	0…3	1	Num
_VisCarPrCF	53581	RW	Par\CF folder visibility	WORD	0…3	3	Num
_VisCarPrUi	53582	RW	Par\Ui folder visibility	WORD	0…3	1	Num
_VisCarCC	53584	RW	FnC\CC folder visibility	WORD	0…3	3	Num
_VisCarCC\UL	53651	RW	FnC\CC\UL folder visibility	WORD	0…3	3	Num
_VisCarCC\dL	53652	RW	FnC\CC\dL folder visibility	WORD	0…3	3	Num
_VisCarCC\Fr	53653	RW	FnC\CC\Fr folder visibility	WORD	0…3	3	Num

Client Table

Client Table

CONTENTS	FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
1	AI	LocalAInput[0]	8336	R	Analog input AIL1	Y	-500…999	0	-1	°C
2		LocalAInput[1]	8337	R	Analog input AIL2	Y	-500…999	0	-1	°C
3		LocalAInput[2]	8338	R	Analog input AIL3	Y	-500…999	0	-1	°C/Bar
4		LocalAInput[3]	8339	R	Analog input AIL4	Y	-500…999	0	-1	°C/Bar
5		LocalAInput[4]	8340	R	Analog input AIL5	Y	-500…999	0	-1	°C
6	DI	LocalDigInput DIL1	8192	R	Digital input DIL1 status		0…1	0		Num
7		LocalDigInput DIL2	8193	R	Digital input DIL2 status		0…1	0		Num
8		LocalDigInput DIL3	8194	R	Digital input DIL3 status		0…1	0		Num
9		LocalDigInput DIL4	8195	R	Digital input DIL4 status		0…1	0		Num
10		LocalDigInput DIL5	8196	R	Digital input DIL5 status		0…1	0		Num
11		LocalDigInput DIL6	8197	R	Digital input DIL6 status		0…1	0		Num
13	DO	LocalDigOutput DOL1	8528	R	Digital output DOL1		0…1	0		Num
14		LocalDigOutput DOL2	8529	R	Digital output DOL2		0…1	0		Num
15		LocalDigOutput DOL3	8530	R	Digital output DOL3		0…1	0		Num
16		LocalDigOutput DOL4	8531	R	Digital output DOL4		0…1	0		Num
17		LocalDigOutput DOL5	8532	R	Digital output DOL5		0…1	0		Num
18		LocalDigOutput DOL6	8533	R	Digital output DOL6		0…1	0		Num
19	AO	LocalDigOutput AOL1	8449	R	Digital output AOL1		0…1	0		Num
20		LocalDigOutput AOL2	8450	R	Digital output AOL2		0…1	0		Num
21		Analog.Out TC1	8448	R	Analog output TCL1	Y	0…100	0		Num
22		Analog.Out AOL1	8449	R	Analog output AOL1	Y	0…100	0		Num
23		Analog.Out AOL2	8450	R	Analog output AOL2	Y	0…100	0		Num
24		Analog.Out ALO3	8451	R	Analog output AOL3	Y	0…999	0	-1	Num
25		Analog.Out AOL4	8452	R	Analog output AOL4	Y	0…999	0	-1	Num
26		Analog.Out AOL5	8453	R	Analog output AOL5	Y	0…999	0	-1	Num
27	AI	ExtAInput[0]	8352	R	Analog input AIE1	Y	-500…999	0	-1	°C
28		ExtAInput[1]	8353	R	Analog input AIE2	Y	-500…999	0	-1	°C
29		ExtAInput[2]	8354	R	Analog input AIE3	Y	-500…999	0	-1	°C/Bar
30		ExtAInput[3]	8355	R	Analog input AIE4	Y	-500…999	0	-1	°C /Bar
31		ExtAInput[4]	8356	R	Analog input AIE5	Y	-500…999	0	-1	°C
32	DI	ExtDigInput DIL1	8224	R	Digital input DIE1 status		0…1	0		Num
33		ExtDigInput DIL2	8225	R	Digital input DIE2 status		0…1	0		Num
34		ExtDigInput DIL3	8226	R	Digital input DIE3 status		0…1	0		Num
35		ExtDigInput DIL4	8227	R	Digital input DIE4 status		0…1	0		Num
36		ExtDigInput DIL5	8228	R	Digital input DIE5 status		0…1	0		Num

CONTENTS	FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	CPL	RANGE	DEFAULT	EXP	U.M.
37		ExtDigInput DIL6	8229	R	Digital input DIE6 status		0…1	0		Num
39	DO	ExtDigOutput DOL1	8544	R	Digital output DOE1		0…1	0		Num
40		ExtDigOutput DOL2	8545	R	Digital output DOE2		0…1	0		Num
41		ExtDigOutput DOL3	8546	R	Digital output DOE3		0…1	0		Num
42		ExtDigOutput DOL4	8547	R	Digital output DOE4		0…1	0		Num
43		ExtDigOutput DOL5	8548	R	Digital output DOE5		0…1	0		Num
44		ExtDigOutput DOL6	8549	R	Digital output DOE6		0…1	0		Num
45	AO	ExtDigOutput AOE1	8465	R	Digital output AOE1		0…1	0		Num
46		ExtDigOutput AOE2	8466	R	Digital output AOE2		0…1	0		Num
47		Analog.Out TCE1	8464	R	Analog output TCE1	Y	0…100	0		Num
48		Analog.Out AOE1	8465	R	Analog output AOE1	Y	0…100	0		Num
49		Analog.Out AOE2	8466	R	Analog output AOE2	Y	0…100	0		Num
50		Analog.Out AOE3	8467	R	Analog output AOE3	Y	0…999	0	-1	Num
51		Analog.Out AOE4	8468	R	Analog output AOE4	Y	0…99	0	-1	Num
52		Analog.Out AOE5	8469	R	Analog output AOE5	Y	0…999	0	-1	Num
53	AI	RemAInput[0]	8432	R	Analog input AIr1	Y	-500…999	0	-1	°C
54		RemAInput[1]	8433	R	Analog input AIr2	Y	-500…999	0	-1	°C/Bar
55	Alarm	Er45	NA	R	Clock error alarm		0…1	0		Flag
56		Er46	NA	R	Time loss alarm		0…1	0		Flag

NA: not accessible.

Commissioning

What's in This Part

What's in This Part

SoMachine HVAC (TM171SW)

What's in This Chapter

Overview

Components and accessories are described below.

General Description

Overview

The SoMachine HVAC (TM171SW) development tool makes it possible to create and customize IEC 61131-3 programs for various types of application. You can download SoMachine HVAC (TM171SW) from www.se.com/en/download/ document/SoMachine+HVAC+-+Programming+Software+for+Modicon+M171-M172+Logic+Controllers/. It is intended for applications in HVAC&R.

There are two accessories that permit data transfer:

- The TM171ADMI programming cable
- The TM171AMFK programming stick

SoMachine HVAC (TM171SW) Software Component

SoMachine HVAC (TM171SW) permits to:

- Create and manage libraries, applications, and diagnostics.
- Manage previously developed applications, upload/download applications, and modify device parameters from a serial port.

TM171ADMI Programming Cable

TM171ADMI programming cable is an USB - TTL adapter. Used in association with the software package, it allows:

- The use of the software itself
- Connection to controllers and expansions supporting the TTL communications
- Connection to TM171AMFK component

NOTICE
INOPERABLE EQUIPMENT
Supply the Modicon M171 Optimized logic controllers only with TM171ADMI programming cable when downloading BIOS parameters and applications.
Failure to follow these instructions can result in equipment damage.

The TM171ADMI is delivered with two cables:

- "Yellow cable":
  - To connect the PC (with TM171ADMI programming cable) to the controller.
  - To connect the TM171AMFK programming stick to the controller
- "Blue cable": To connect the PC (with TM171ADMI programming cable) to the TM171AMFK programming stick

TM171AMFK Programming Stick

The TM171AMFK programming stick is a TTL data memory support, which allows to:

- Download the parameter values to the device
- Upload the parameter values from the device
- Download IEC application to the device
- Update the firmware of the device

The TM171AMFK can be connected to:

- The controller with the "Yellow cable"
- The PC with the "Blue cable"

Data Transfer

Overview

The TM171ADMI programming cable and the TM171AMFK programming stick can be connected to the controllers to transfer:

- Device Parameters
- BIOS
- IEC application

Connecting the PC to the Controller

In direct connection of the PC to the controller, the controller must not be connected to ground. If a ground (earth) connection exists for the PC as well as the controller, a ground loop condition could develop and render either PC or the controller inoperable.

NOTICE
INOPERABLE EQUIPMENT
Disconnect any ground connection of the M171O before connecting a PC.
Failure to follow these instructions can result in equipment damage.

NOTICE
INOPERABLE EQUIPMENT
- Always connect the communication cable to the PC before connecting it to the controller.   - Always disconnect the communication cable from the controller before disconnecting it from the PC.
Failure to follow these instructions can result in equipment damage.

Following operations are possible between the PC (with TM171ADMI) and the controller in direct connection:

Data type	PC (with TM171ADMI) → Controller	Controller →PC (with TM171ADMI)
Parameters	✓	✓
BIOS	✓	-
IEC	✓	-

Direct connection between the PC (with TM171ADMI) and the controller:
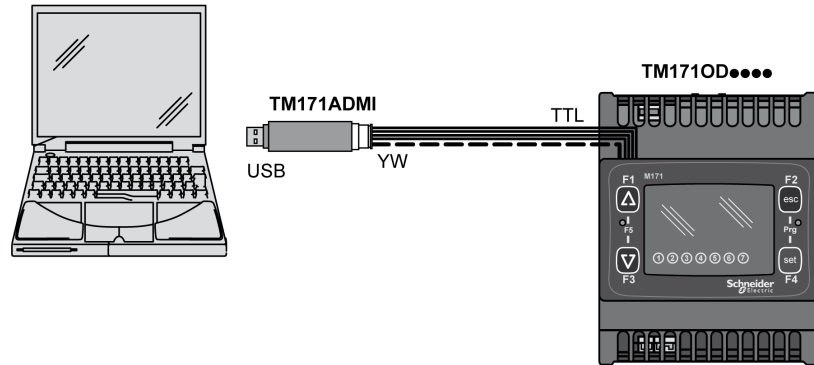
To connect the PC (with TM171ADMI) to the controller, use the "Yellow cable" delivered with the TM171ADMI, page 21.

Connecting the PC to the TM171AMFK

Following operations are possible between the PC (with TM171ADMI) and the TM171AMFK:

Data type	PC (with TM171ADMI) → TM171AMFK	TM171AMFK → PC (with TM171ADMI)
Parameters	-	-
BIOS	✓	-
IEC	✓	-

Connection between the PC (with TM171ADMI) and the TM171AMFK:
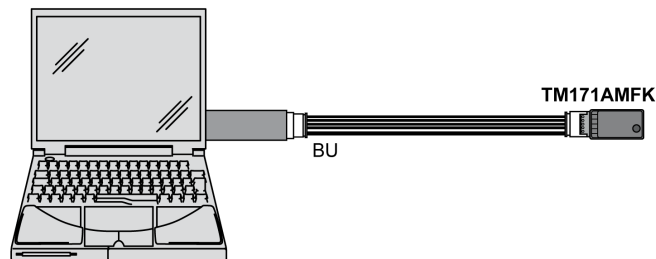
To connect the PC (with TM171ADMI) to the TM171AMFK, use the "Blue cable" delivered with the TM171ADMI, page 21.

Connecting the TM171AMFK Programming Stick to the Controller

Following operations are possible between the TM171AMFK and the controller:

Data type	TM171AMFK → Controller	Controller → TM171AMFK
Parameters	✓	✓
BIOS	✓	-
IEC	✓	-

Connection between the TM171AMFK and the controller:
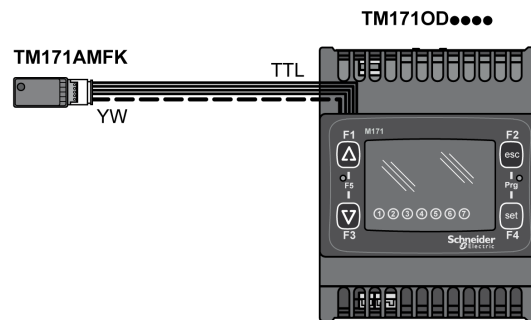
To connect the TM171AMFK to the controller, use the "Yellow cable" delivered with the TM171ADMI, page 21.

For details on the procedure, refer to the programming/function description, page 121.

Configuration with Modbus RTU

What's in This Chapter

The TTL serial, also called COM1, can be used to configure the device, parameters, states, and variables using the Modbus protocol.

Basics

Modbus Overview

Modbus is a client/server protocol for communication between network-connected devices.

Modbus devices communicate using a master/slave technique in which a single device (the master) can send messages. The other devices in the network (slaves) respond by returning the data requested to the master or executing the action indicated in the message received. A slave is defined as a device connected to a network that processes information and sends the results to a master using the Modbus protocol.

The master can send messages to individual slaves or to the entire network (broadcast) while slaves can only reply to messages received individually from the master.

> **NOTE:** The Modbus standard used by Schneider Electric uses RTU coding for data transmission.

Data Format (RTU)

The data coding model used defines the structure of messages sent to the network and the way in which the information is decoded. The type of coding selected is based on specific parameters (baudrate, parity, and so on) configured with parameters and some devices only support specific code models. However, the same model must be used for all devices connected to a Modbus network.

The protocol used the RTU binary method with the following bytes:

- 8 bits for data,
- Even parity bit (not configurable),
- 1 stop bit.

The device is fully configurable via parameter settings. They can be modified:

- With the device keys.
- With the TM171AMFK programming stick.
- By sending data via:
  ◦ The Modbus protocol to individual instruments, or
  ◦ Via broadcast, using the address 0 (broadcast).

Follow the wiring example provided when using Modbus, page 85.

You can also use a bus adapter with the following cables:

Connection type	Cable type
Device <-> Bus adapter	5-wire TTL cable (30 cm/11.8 in) in length
Bus adapter	-
Bus adapter <-> Interface	RS-485 cable shielded and twisted

Modbus Commands Available and Data Areas

The implemented commands are:

Modbus command	Description of command
3	Read multiple registers on Client side
6	Write single register on Client side
16	Write multiple registers on Client side
43	Read device ID
	Field description:
	0=Manufacturer ID
	1=Model ID
	2=Version ID

Data Areas

The length restrictions are:

Messages type	Maximum length
Messages sent to device	30 bytes
Messages received by device	30 bytes

For more information, refer to Client table, page 140.

Modbus Addresses

Device Address

The Device Number in a Modbus message is defined by the parameter CF30, page 137.

The address 0 is used for broadcast messages that all slaves recognize.

NOTE: Slaves do not reply to broadcast messages.

Parameter Addresses

The Modbus addresses of the parameters are in the chapter Parameters table, page 133.

Variable / State Addresses

The list of addresses of the Variable / State is in the chapter client table, page 140.

Appendices

Appendices

What's in This Chapter

NTC 10k beta 3435 Resistance Temperature Table

Celsius

T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)
-40	187 400	-13	48 590	14	15 270	41	5 630	68	2 366	95	1 108
-39	177 500	-12	46 410	15	14 680	42	5 440	69	2 296	96	1 080
-38	168 200	-11	44 350	16	14 110	43	5 257	70	2 229	97	1 052
-37	159 400	-10	42 390	17	13 570	44	5 081	71	2 164	98	1 025
-36	151 100	-9	40 500	18	13 050	45	4 912	72	2 101	99	999.0
-35	143 400	-8	38 700	19	12 560	46	4 750	73	2 040	100	973.7
-34	136 100	-7	37 000	20	12 090	47	4 594	74	1 981	101	949.0
-33	129 200	-6	35 380	21	11 630	48	4 444	75	1 925	102	925.0
-32	122 800	-5	33 850	22	11 200	49	4 300	76	1 870	103	901.8
-31	116 700	-4	32 390	23	10 780	50	4 162	77	1 817	104	879.3
-30	110 900	-3	31 000	24	10 380	51	4 027	78	1 766	105	857.4
-29	105 400	-2	29 690	25	10 000	52	3 897	79	1 716	106	836.3
-28	100 100	-1	28 440	26	9 633	53	3 773	80	1 669	107	815.7
-27	95 220	0	27 250	27	9 281	54	3 653	81	1 622	108	795.8
-26	90 570	1	26 100	28	8 945	55	3 537	82	1 577	109	776.4
-25	86 180	2	2 500	29	8 623	56	3 426	83	1 534	110	757.6
-24	82 040	3	23 960	30	8 314	57	3 319	84	1 492	111	739.2
-23	78 130	4	22 970	31	8 016	58	3 216	85	1 451	112	721.4
-22	74 440	5	22 030	32	7 730	59	3 117	86	1 412	113	704.1
-21	70 940	6	21 130	33	7 456	60	3 022	87	1 374	114	687.3
-20	67 640	7	20 280	34	7 193	61	2 929	88	1 337	115	671.0
-19	64 440	8	19 460	35	6 941	62	2 839	89	1 301	116	655.2
-18	61 420	9	18 690	36	6 700	63	2 753	90	1 266	117	639.8
-17	58 570	10	17 950	37	6 468	64	2 670	91	1 233	118	624.8
-16	55 870	11	17 230	38	6 246	65	2 589	92	1 200	119	610.3
-15	53 310	12	16 550	39	6 033	66	2 512	93	1 169	120	596.1
-14	50 880	13	15 900	40	5 829	67	2 438	94	1 138		

Fahrenheit

T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)
-40.0	187 400	8.6	48 590	57.2	15 270	105.8	5 630	154.4	2 366	203.0	1 108
-38.2	177 500	10.4	46 410	59.0	14 680	107.6	5 440	156.2	2 296	204.8	1 080
-36.4	168 200	12.2	44 350	60.8	14 110	109.4	5 257	158.0	2 229	206.6	1 052
-34.6	159 400	14.0	42 390	62.6	13 570	111.2	5 081	159.8	2 164	208.4	1 025

T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)
-32.8	151 100	15.8	40 500	64.4	13 050	113.0	4 912	161.6	2 101	210.2	999.0
-31.0	143 400	17.6	38 700	66.2	12 560	114.8	4 750	163.4	2 040	212.0	973.7
-29.2	136 100	19.4	37 000	68.0	12 090	116.6	4 594	165.2	1 981	213.8	949.0
-27.4	129 200	21.2	35 380	69.8	11 630	118.4	4 444	167.0	1 925	215.6	925.0
-25.6	122 800	23.0	33 850	71.6	11 200	120.2	4 300	168.8	1 870	217.4	901.8
-23.8	116 700	24.8	32 390	73.4	10 780	122.0	4 162	170.6	1 817	219.2	879.3
-22.0	110 900	26.6	31 000	75.2	10 380	123.8	4 027	172.4	1 766	221.0	857.4
-20.2	105 400	28.4	29 690	77.0	10 000	125.6	3 897	174.2	1 716	222.8	836.3
-18.4	100 100	30.2	28 440	78.8	9 633	127.4	3 773	176.0	1 669	224.6	815.7
-16.6	95 220	32.0	27 250	80.6	9 281	129.2	3 653	177.8	1 622	226.4	795.8
-14.8	90 570	33.8	26 100	82.4	8 945	131.0	3 537	179.6	1 577	228.2	776.4
-13.0	86 180	35.6	2 500	84.2	8 623	132.8	3 426	181.4	1 534	230.0	757.6
-11.2	82 040	37.4	23 960	86.0	8 314	134.6	3 319	183.2	1 492	231.8	739.2
-9.4	78 130	39.2	22 970	87.8	8 016	136.4	3 216	185.0	1 451	233.6	721.4
-7.6	74 440	41.0	22 030	89.6	7 730	138.2	3 117	186.8	1 412	235.4	704.1
-5.8	70 940	42.8	21 130	91.4	7 456	140.0	3 022	188.6	1 374	237.2	687.3
-4.0	67 640	44.6	20 280	93.2	7 193	141.8	2 929	190.4	1 337	239.0	671.0
-2.2	64 440	46.4	19 460	95.0	6 941	143.6	2 839	192.2	1 301	240.8	655.2
-0.4	61 420	48.2	18 690	96.8	6 700	145.4	2 753	194.0	1 266	242.6	639.8
1.4	58 570	50.0	17 950	98.6	6 468	147.2	2 670	195.8	1 233	244.4	624.8
3.2	55 870	51.8	17 230	100.4	6 246	149.0	2 589	197.6	1 200	246.2	610.3
5.0	53 310	53.6	16 550	102.2	6 033	150.8	2 512	199.4	1 169	248.0	596.1
6.8	50 880	55.4	15 900	104.0	5 829	152.6	2 438	201.2	1 138		

PT1000 Resistance Temperature Table

Celsius

T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)
-100	602.56	-73	711.34	-46	818.94	-19	925.53	8	1 031.23	35	1 136.08
-99	606.61	-72	715.34	-45	822.90	-18	929.46	9	1 035.13	36	1 139.95
-98	610.66	-71	719.34	-44	826.87	-17	933.39	10	1 039.03	37	1 143.82
-97	614.71	-70	723.35	-43	830.83	-16	937.32	11	1 042.92	38	1 147.68
-96	618.76	-69	727.35	-42	834.79	-15	941.24	12	1 046.82	39	1 151.55
-95	622.80	-68	731.34	-41	838.75	-14	945.17	13	1 050.71	40	1 155.41
-94	626.84	-67	735.34	-40	842.71	-13	949.09	14	1 054.60	41	1 159.27
-93	630.88	-66	739.34	-39	846.66	-12	953.02	15	1 058.49	42	1 163.13
-92	634.92	-65	743.33	-38	850.62	-11	956.94	16	1 062.38	43	1 166.99
-91	638.96	-64	747.32	-37	854.57	-10	960.86	17	1 066.27	44	1 170.85
-90	643.00	-63	751.31	-36	858.53	-9	964.78	18	1 070.16	45	1 174.70
-89	647.03	-62	755.30	-35	862.48	-8	968.70	19	1 074.05	46	1 178.56
-88	651.06	-61	759.29	-34	866.43	-7	972.61	20	1 077.94	47	1 182.41
-87	655.09	-60	763.28	-33	870.38	-6	976.53	21	1 081.82	48	1 186.27
-86	659.12	-59	767.26	-32	874.32	-5	980.44	22	1 085.70	49	1 190.12
-85	663.15	-58	771.25	-31	878.27	-4	984.36	23	1 089.59	50	1 193.97

T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)
-84	667.17	-57	775.23	-30	882.22	-3	988.27	24	1 093.47	51	1 197.82
-83	671.20	-56	779.21	-29	886.16	-2	992.18	25	1 097.35	52	1 201.67
-82	675.22	-55	783.19	-28	890.10	-1	996.09	26	1 101.23	53	1 205.52
-81	679.24	-54	787.17	-27	894.04	0	1 000.00	27	1 105.10	54	1 209.36
-80	683.25	-53	791.14	-26	897.98	1	1 003.91	28	1 108.98	55	1 213.21
-79	687.27	-52	795.12	-25	901.92	2	1 007.81	29	1 112.86	56	1 217.05
-78	691.29	-51	799.09	-24	905.86	3	1 011.72	30	1 116.73	57	1 220.90
-77	695.30	-50	803.06	-23	909.80	4	1 015.62	31	1 120.60	58	1 224.74
-76	699.31	-49	807.03	-22	913.73	5	1 019.53	32	1 124.47	59	1 228.58
-75	703.32	-48	811.00	-21	917.67	6	1 023.43	33	1 128.35	60	1 232.42
-74	707.33	-47	814.97	-20	921.60	7	1 027.33	34	1 132.21	61	1 236.26

T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)	T (°C)	Rt (Ω)
62	1 240.09	86	1 331.84	110	1 422.93	134	1 513.34	158	1 603.09	182	1 692.18
63	1 243.93	87	1 335.65	111	1 426.71	135	1 517.10	159	1 606.82	183	1 695.88
64	1 247.77	88	1 339.46	112	1 430.49	136	1 520.85	160	1 610.54	184	1 699.58
65	1 251.60	89	1 343.26	113	1 434.26	137	1 524.60	161	1 614.27	185	1 703.27
66	1 255.43	90	1 347.07	114	1 438.04	138	1 528.35	162	1 617.99	186	1 706.96
67	1 259.26	91	1 350.87	115	1 441.82	139	1 532.10	163	1 621.71	187	1 710.66
68	1 263.09	92	1 354.68	116	1 445.59	140	1 535.84	164	1 625.43	188	1 714.35
69	1 266.92	93	1 358.48	117	1 449.37	141	1 539.59	165	1 629.15	189	1 718.04
70	1 270.75	94	1 362.28	118	1 453.14	142	1 543.33	166	1 632.86	190	1 721.73
71	1 274.58	95	1 366.08	119	1 456.91	143	1 547.08	167	1 636.58	191	1 725.42
72	1 278.40	96	1 369.87	120	1 460.68	144	1 550.82	168	1 640.30	192	1 729.10
73	1 282.23	97	1 373.67	121	1 464.45	145	1 554.56	169	1 644.01	193	1 732.79
74	1 286.05	98	1 377.47	122	1 468.22	146	1 558.30	170	1 647.72	194	1 736.48
75	1 289.87	99	1 381.26	123	1 471.98	147	1 562.04	171	1 651.43	195	1 740.16
76	1 293.70	100	1 385.06	124	1 475.75	148	1 565.78	172	1 655.14	196	1 743.84
77	1 297.52	101	1 388.85	125	1 479.51	149	1 569.52	173	1 658.85	197	1 747.52
78	1 301.33	102	1 392.64	126	1 483.28	150	1 573.25	174	1 662.56	198	1 751.20
79	1 305.15	103	1 396.43	127	1 487.04	151	1 576.99	175	1 666.27	199	1 754.88
80	1 308.97	104	1 400.22	128	1 490.80	152	1 580.72	176	1 669.97	200	1 758.56
81	1 312.78	105	1 404.00	129	1 494.56	153	1 584.45	177	1 673.68		
82	1 316.60	106	1 407.79	130	1 498.32	154	1 588.18	178	1 677.38		
83	1 320.41	107	1 411.58	131	1 502.08	155	1 591.91	179	1 681.08		
84	1 324.22	108	1 415.36	132	1 505.83	156	1 595.64	180	1 684.78		
85	1 328.03	109	1 419.14	133	1 509.59	157	1 599.37	181	1 688.48		

Fahrenheit

T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)
-148.0	602.56	-99.4	711.34	-50.8	818.94	-2.2	925.53	46.4	1 031.23	95.0	1 136.08
-146.2	606.61	-97.6	715.34	-49.0	822.90	-0.4	929.46	48.2	1 035.13	96.8	1 139.95
-144.4	610.66	-95.8	719.34	-47.2	826.87	1.4	933.39	50.0	1 039.03	98.6	1 143.82
-142.6	614.71	-94.0	723.35	-45.4	830.83	3.2	937.32	51.8	1 042.92	100.4	1 147.68
-140.8	618.76	-92.2	727.35	-43.6	834.79	5.0	941.24	53.6	1 046.82	102.2	1 151.55

T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)
-139.0	622.80	-90.4	731.34	-41.8	838.75	6.8	945.17	55.4	1 050.71	104.0	1 155.41
-137.2	626.84	-88.6	735.34	-40.0	842.71	8.6	949.09	57.2	1 054.60	105.8	1 159.27
-135.4	630.88	-86.8	739.34	-38.2	846.66	10.4	953.02	59.0	1 058.49	107.6	1 163.13
-133.6	634.92	-85.0	743.33	-36.4	850.62	12.2	956.94	60.8	1 062.38	109.4	1 166.99
-131.8	638.96	-83.2	747.32	-34.6	854.57	14.0	960.86	62.6	1 066.27	111.2	1 170.85
-130.0	643.00	-81.4	751.31	-32.8	858.53	15.8	964.78	64.4	1 070.16	113.0	1 174.70
-128.2	647.03	-79.6	755.30	-31.0	862.48	17.6	968.70	66.2	1 074.05	114.8	1 178.56
-126.4	651.06	-77.8	759.29	-29.2	866.43	19.4	972.61	68.0	1 077.94	116.6	1 182.41
-124.6	655.09	-76.0	763.28	-27.4	870.38	21.2	976.53	69.8	1 081.82	118.4	1 186.27
-122.8	659.12	-74.2	767.26	-25.6	874.32	23.0	980.44	71.6	1 085.70	120.2	1 190.12
-121.0	663.15	-72.4	771.25	-23.8	878.27	24.8	984.36	73.4	1 089.59	122.0	1 193.97
-119.2	667.17	-70.6	775.23	-22.0	882.22	26.6	988.27	75.2	1 093.47	123.8	1 197.82
-117.4	671.20	-68.8	779.21	-20.2	886.16	28.4	992.18	77.0	1 097.35	125.6	1 201.67
-115.6	675.22	-67.0	783.19	-18.4	890.10	30.2	996.09	78.8	1 101.23	127.4	1 205.52
-113.8	679.24	-65.2	787.17	-16.6	894.04	32.0	1 000.00	80.6	1 105.10	129.2	1 209.36
-112.0	683.25	-63.4	791.14	-14.8	897.98	33.8	1 003.91	82.4	1 108.98	131.0	1 213.21
-110.2	687.27	-61.6	795.12	-13.0	901.92	35.6	1 007.81	84.2	1 112.86	132.8	1 217.05
-108.4	691.29	-59.8	799.09	-11.2	905.86	37.4	1 011.72	86.0	1 116.73	134.6	1 220.90
-106.6	695.30	-58.0	803.06	-9.4	909.80	39.2	1 015.62	87.8	1 120.60	136.4	1 224.74
-104.8	699.31	-56.2	807.03	-7.6	913.73	41.0	1 019.53	89.6	1 124.47	138.2	1 228.58
-103.0	703.32	-54.4	811.00	-5.8	917.67	42.8	1 023.43	91.4	1 128.35	140.0	1 232.42
-101.2	707.33	-52.6	814.97	-4.0	921.60	44.6	1 027.33	93.2	1 132.21	141.8	1 236.26

T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)	T (°F)	Rt (Ω)
143.6	1 240.09	186.8	1 331.84	230.0	1 422.93	273.2	1 513.34	316.4	1 603.09	359.6	1 692.18
145.4	1 243.93	188.6	1 335.65	231.8	1 426.71	275.0	1 517.10	318.2	1 606.82	361.4	1 695.88
147.2	1 247.77	190.4	1 339.46	233.6	1 430.49	276.8	1 520.85	320.0	1 610.54	363.2	1 699.58
149.0	1 251.60	192.2	1 343.26	235.4	1 434.26	278.6	1 524.60	321.8	1 614.27	365.0	1 703.27
150.8	1 255.43	194.0	1 347.07	237.2	1 438.04	280.4	1 528.35	323.6	1 617.99	366.8	1 706.96
152.6	1 259.26	195.8	1 350.87	239.0	1 441.82	282.2	1 532.10	325.4	1 621.71	368.6	1 710.66
154.4	1 263.09	197.6	1 354.68	240.8	1 445.59	284.0	1 535.84	327.2	1 625.43	370.4	1 714.35
156.2	1 266.92	199.4	1 358.48	242.6	1 449.37	285.8	1 539.59	329.0	1 629.15	372.2	1 718.04
158.0	1 270.75	201.2	1 362.28	244.4	1 453.14	287.6	1 543.33	330.8	1 632.86	374.0	1 721.73
159.8	1 274.58	203.0	1 366.08	246.2	1 456.91	289.4	1 547.08	332.6	1 636.58	375.8	1 725.42
161.6	1 278.40	204.8	1 369.87	248.0	1 460.68	291.2	1 550.82	334.4	1 640.30	377.6	1 729.10
163.4	1 282.23	206.6	1 373.67	249.8	1 464.45	293.0	1 554.56	336.2	1 644.01	379.4	1 732.79
165.2	1 286.05	208.4	1 377.47	251.6	1 468.22	294.8	1 558.30	338.0	1 647.72	381.2	1 736.48
167.0	1 289.87	210.2	1 381.26	253.4	1 471.98	296.6	1 562.04	339.8	1 651.43	383.0	1 740.16
168.8	1 293.70	212.0	1 385.06	255.2	1 475.75	298.4	1 565.78	341.6	1 655.14	384.8	1 743.84
170.6	1 297.52	213.8	1 388.85	257.0	1 479.51	300.2	1 569.52	343.4	1 658.85	386.6	1 747.52
172.4	1 301.33	215.6	1 392.64	258.8	1 483.28	302.0	1 573.25	345.2	1 662.56	388.4	1 751.20
174.2	1 305.15	217.4	1 396.43	260.6	1 487.04	303.8	1 576.99	347.0	1 666.27	390.2	1 754.88
176.0	1 308.97	219.2	1 400.22	262.4	1 490.80	305.6	1 580.72	348.8	1 669.97	392.0	1 758.56
177.8	1 312.78	221.0	1 404.00	264.2	1 494.56	307.4	1 584.45	350.6	1 673.68		
179.6	1 316.60	222.8	1 407.79	266.0	1 498.32	309.2	1 588.18	352.4	1 677.38		
181.4	1 320.41	224.6	1 411.58	267.8	1 502.08	311.0	1 591.91	354.2	1 681.08		
183.2	1 324.22	226.4	1 415.36	269.6	1 505.83	312.8	1 595.64	356.0	1 684.78		

T (°F)	Rt (Ω)		T (°F)	Rt (Ω)		T (°F)	Rt (Ω)		T (°F)	Rt (Ω)		T (°F)	Rt (Ω)		T (°F)	Rt (Ω)
185.0	1 328.03		228.2	1 419.14		271.4	1 509.59		314.6	1 599.37		357.8	1 688.48			

Glossary

A

ADC:

(*analog/digital converter*)

AFB:

(*application function block*)

analog input:

Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

analog output:

Converts numerical values within the logic controller and sends out proportional voltage or current levels.

application:

A program including configuration data, symbols, and documentation.

AWG:

(*American wire gauge*) The standard that specifies wire section sizes in North America.

B

BOOL:

(*boolean*) A basic data type in computing. A `BOOL` variable can have one of these values: 0 (`FALSE`), 1 (`TRUE`). A bit that is extracted from a word is of type `BOOL`.

byte:

A type that is encoded in an 8-bit format, ranging from 00 hex to FF hex.

C

controller:

Automates industrial processes (also known as programmable logic controller or programmable controller).

CSA:

(*Canadian standards association*) The Canadian standard for industrial electronic equipment in hazardous environments.

D

digital I/O:

(*digital input/output*) An individual circuit connection at the electronic module that corresponds directly to a data table bit. The data table bit holds the value of the signal at the I/O circuit. It gives the control logic digital access to I/O values.

DWORD:

(*double word*) Encoded in 32-bit format.

E

EEPROM:

(*electrically erasable programmable read-only memory*) A type of non-volatile memory to store required data even when power is removed.

NOTE:

EIA:

(*electronic industries alliance*) The trade organization for establishing electrical/electronic and data communication standards (including RS-232 and RS-485) in the United States.

EMC:

(*electromagnetic compatibility*)

EN:

EN identifies one of many European standards maintained by CEN (*European Committee for Standardization*), CENELEC (*European Committee for Electrotechnical Standardization*), or ETSI (*European Telecommunications Standards Institute*).

expansion bus:

An electronic communication bus between expansion I/O modules and a controller.

expansion I/O module:

(*expansion input/output module*) Either a digital or analog module that adds additional I/O to the base controller.

F

FE:

(functional Earth) A common grounding connection to enhance or otherwise allow normal operation of electrically sensitive equipment (also referred to as functional ground in North America).

In contrast to a protective Earth (protective ground), a functional earth connection serves a purpose other than shock protection, and may normally carry current. Examples of devices that use functional earth connections include surge suppressors and electromagnetic interference filters, certain antennas, and measurement instruments.

firmware:

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

flash memory:

A non-volatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

H

hex:

(*hexadecimal*)

HVAC&R:

(*heating, ventilation, and air conditioning and refrigeration)*

HVAC:

(*heating, ventilation, and air conditioning)* Applications to monitor and control indoor environments.

I

input terminal:

A collection of connection points between the field wiring and the I/O modules or those integrated into the controller.

I/O terminal:

(*input/output terminal*) A collection of connection points between the field wiring and the I/O modules or those integrated into the controller.

I/O:

(*input/output*)

ID:

(*identifier/identification*)

IEC 61131-3:

Part 3 of a 3-part IEC standard for industrial automation equipment. IEC 61131-3 is concerned with controller programming languages and defines 2 graphical and 2 textual programming language standards. The graphical programming languages are ladder diagram and function block diagram. The textual programming languages include structured text and instruction list.

IEC:

(*international electrotechnical commission*) A non-profit and non-governmental international standards organization that prepares and publishes international standards for electrical, electronic, and related technologies.

IP 20:

(*ingress protection*) The protection classification according to IEC 60529 offered by an enclosure, shown by the letter IP and 2 digits. The first digit indicates 2 factors: helping protect persons and for equipment. The second digit indicates helping protect against water. IP 20 devices help protect against electric contact of objects larger than 12.5 mm, but not against water.

L

LAN:

(*local area network*) A short-distance communications network that is implemented in a home, office, or institutional environment.

LCD:

(*liquid crystal display* Used in many HMI devices to display menus and messages to machine operators.

LED:

(*light emitting diode*) An indicator that illuminates under a low-level electrical charge.

M

master/slave:

The single direction of control in a network that implements the master/slave mode.

Modbus SL:

(*Modbus serial line* The implementation of the protocol over a RS-232 or RS-485 serial connection.

Modbus:

The protocol that allows communications between many devices connected to the same network.

ms:

(*millisecond*)

N

N/A:

(*not applicable*)

N/C:

(*normally closed*) A contact pair that closes when the actuator is de-energized (no power is applied) and opens when the actuator is energized (power is applied).

N/O:

(*normally open*) A contact pair that opens when the actuator is de-energized (no power is applied) and closes when the actuator is energized (power is applied).

NAK:

(*negative acknowledge*)

NC:

(*not connected*)

network:

A system of interconnected devices that share a common data path and protocol for communications.

non-volatile memory:

A memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

NTC:

(*Negative Temperature Coefficient*)

O

output terminal:

A collection of connection points between the field wiring and the I/O modules or those integrated into the controller.

P

PE:

(*Protective Earth*) A common grounding connection to help avoid the hazard of electric shock by keeping any exposed conductive surface of a device at earth potential. To avoid possible voltage drop, no current is allowed to flow in this conductor (also referred to as *protective ground* in North America or as an equipment grounding conductor in the US national electrical code).

PLC:

(*programmable logic controller*) An industrial computer used to automate manufacturing, industrial, and other electromechanical processes. PLCs are different from common computers in that they are designed to have multiple input and output arrays and adhere to more robust specifications for shock, vibration, temperature, and electrical interference among other things.

power supply terminals:

The power supply is connected to these terminals to provide power to the controller.

PPM:

(*Pulse-Position Modulation*)

protocol:

A convention or standard definition that controls or enables the connection, communication, and data transfer between 2 computing system and devices.

Pt100/Pt1000:

(*platinum 100/1000*) Resistance thermometers, also referred to as resistance temperature detectors, are sensors used to measure temperature by correlating electrical resistance with temperature. As the temperature changes, the resistance to an electrical current passing through them predictably changes likewise. They are characterized by their nominal resistance R0 at a temperature of 0 °C.

- Pt100 (R0 = 100 Ω)
- Pt1000 (R0 = 1 kΩ)

PWM:

(*pulse width modulation*) A fast output that oscillates between off and on in an adjustable duty cycle, producing a rectangular wave form (though you can adjust it to produce a square wave). The PWM is well adapted to simulate or approximate an analog output in that it regulates the voltage of the output over its period making it useful in light dimming or speed control applications, among others.

R

RS-485:

A standard type of serial communication bus, based on 2 wires (also known as EIA RS-485).

RTC:

(*real-time clock*) A battery-backed time-of-day and calender clock that operates continuously, even when the controller is not powered for the life of the battery.

RTU:

(*remote terminal unit*) A device that interfaces with objects in the physical world to a distributed control system or SCADA system by transmitting telemetry data to the system and/or altering the state of connected objects based on control messages received from the system.

S

SELV:

(*safety extra low voltage*) A system that follows IEC 61140 guidelines for power supplies is protected in such a way that voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for class 1 equipment) does not exceed a specified value under normal conditions or under inoperable conditions.

sink input:

A wiring arrangement in which the device provides current to the input electronic module. A sink input is referenced to 0 Vdc.

SL:

(*serial line*)

SoMachine HVAC:

A comprehensive controller development system software tool for configuring and programming the Modicon M17x logic controller and devices compliant with IEC 61131-3.

STOP:

A command that causes the controller to stop running an application program.

T

terminal block:

(*terminal block*) The component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

TRIAC:

(*triode for alternating current*)

U

UL:

(*underwriters laboratories*) A US organization for product testing and safety certification.

V

variable:

A memory unit that is addressed and modified by a program.

W

WORD:

A type encoded in a 16-bit format.

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As standards, specifications, and design change from time to time,
please ask for confirmation of the information given in this publication.

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